The Development and Feasibility Testing of a School-Based Burns Prevention and First-Aid Intervention: Learn About Burns

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This work has not been submitted in substance for any other degree or award at this or any other university or place of learning, not is being submitted concurrently in candidature for any degree or other award.

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Summary

School-aged children are susceptible to burn injuries and have little knowledge of the correct first-aid to apply when injuries occur. Currently, no school-based intervention which targets both burn prevention and first-aid to meet national guidelines exists. To address this gap a school-based burns prevention and first-aid intervention was developed, and feasibility tested following the Medical Research Council guidelines on the development and evaluation of complex interventions.

A systematic review on what interventions work in the prevention of unintentional injuries for school-aged children was conducted. Results highlighted a dearth in high quality evaluations of interventions, and the need for appropriate development studies of interventions prior to evaluation for effectiveness. A cross-sectional epidemiological study assessed the patterns of burns for school-aged children. Results identified the target age-group, agents and mechanisms to address and showed that few children received appropriate first-aid. Results from these studies were used, alongside educational and logic modelling theory, to develop the Learn About Burns intervention. The intervention was feasibility tested in six schools in the Cardiff Local Education Authority. Results from the feasibility study suggest the intervention was feasible and acceptable and wider scale piloting should take place following intervention refinement. Qualitative data indicated that students and teachers thought the intervention was enjoyable and engaging for students and integrated with the curriculum and classroom timetable. Quantitative results suggest that the intervention increased student burn prevention and first-aid knowledge, student attitude and self-efficacy towards burn prevention and providing burns first-aid and increased appropriate safety practices – these increases were sustained over six-months. This thesis makes important contributions to knowledge in the field of burn prevention research. It highlights the need to improve quality of the development of evaluations and provides a feasible and acceptable school-based intervention to prevent burns and promote the application of first aid.

Abbreviations

BAS : Before and after study

BaSAT : Burns and Scalds Assessment Template

BBA : British Burns Association

BFAT : Burns first-aid treatment

BU : Burns Unit

CAN : Canada

CAPT : Child Accident Prevention Trust

CASP : Critical Appraisal Skills Programme

CBAS : Controlled before and after study

CBRD : Children's burns research network database

CHSS : Cardiff Healthy School Scheme

CI : Confidence interval

CLEA : Cardiff Local Education Authority

CONSORT : Consolidated Standards of Reporting Trials

cRCT : Cluster randomised controlled trial

ED : Emergency Department

FSM : Free school meal status

HES : Hospital Episode Statistics (English dataset)

HIC : High-income country

ICD-10 : International Classification of Diseases 10th Revision

IMD : Index of multiple deprivation

IND : India

IWB : Interactive white board

KAP : Knowledge, attitude and practice

KAS : Knowledge, attitude and self-efficacy

KASP : Knowledge, attitude, self-efficacy and practice

LMIC : Low- and middle-income country

LSOA : Lower super output area

MIU : Minor Injury Unit

MRC : Medical Research Council

NHS : National Health Service

NNBC : National Network for Burn Care

NRCS : Non-randomised controlled study

NZ : New Zealand

OECD : Organisation for Economic Co-operation and Development

PEDW : The Patient Episode Database for Wales

PICOS : Population, intervention, comparator, outcomes and study

PPI : Patient and public involvement

PRISMA : Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RCT : Randomised controlled trial

RoSPA : Royal Society for the Prevention of Accidents

SES : Socio-economic status

SMREC : School of Medicine Research Ethics Committee

SMT : Senior management team

SPSS : Statistical Package for the Social Sciences

STROBE : Strengthening the reporting of observational studies in epidemiology

SURE : Specialist Unit for Review Evidence

TBSA : Total body surface area

UK : United Kingdom

USA : United States of America

WHO : World Health Organisation

WIMD : Welsh index of multiple deprivation

Table of Contents

Chapter Three - What interventions prevent unintentional burns in school-aged children? A systematic review

Chapter Four - Intervention Development

Chapter Five - Methods of a Feasibility Study of the Learn About Burns Intervention

Chapter Six - Quantitative Results from the Learn About Burns Feasibility Study

Chapter Eight - General Discussion

Table of Tables

Table of Figures

Thesis Synopsis

The thesis contains eight chapters. Chapter one presents an introduction to the topic of childhood burns (prevalence, definitions, treatments, outcomes, risk factors), existing prevention efforts and outlines the aims and objectives of this thesis. Chapter two presents an epidemiological study of the pattern of burn injuries and first-aid received by a population of school-aged children (aged 5 – 16 years) who presented to selected emergency departments, minor injury units and burns units, in England and Wales. Chapter three presents a systematic review of the effectiveness of interventions in preventing burn injuries to school-aged children. Informed by findings from the systematic review and epidemiological study, chapter four presents the development and logic model for 'Learn About Burns' (a school-based burns prevention and first-aid intervention). Chapter five presents the methods used in the mixed-methods feasibility study of 'Learn About Burns'. Results from the feasibility study are presented in chapters six (quantitative results) and seven (qualitative results). Chapter eight is the discussion presenting the contributions that this thesis makes to knowledge, draws comparisons to the existing relevant literature, identifies strengths and weaknesses, and implications of this body of work for policy and practice.

Chapter One: Introduction

Child injuries are not necessarily purely 'accidental' or random events; to a degree they are predictable and therefore largely preventable. As a public health problem, injuries cannot and indeed must not, be neglected any longer. Now is the time to challenge the notion that injuries are unavoidable and make room for a pro-active, preventive approach'

(WHO, 2005:5)

1.1 Chapter Introduction

The current chapter provides an overview of the prevalence and consequences of childhood burns, how burns are classified, recommendations on the burns first-aid treatment (BFAT) and burn injury prevention for school-aged children. The research aims and objectives of this thesis are presented at the end this chapter.

1.2 Background

Between January 2003 and December 2011 over 81,000 burn injuries were referred for assessment to burn services in England and Wales across all ages (Stylianou et al., 2014). Of these, more than 57,000 (70.1%) required admission to the specialist service (the specialist service is the National Network for Burn Care (NNBC) provided by the NHS) (Stylianou et al., 2014). Over 40% of these admissions each year are for those aged less than 16 years (Stylianou et al., 2014). Due to the prevalence and complexity of childhood burns, children less than 16 years old account for an estimated 41.7% of the general workload of specialised burn injury services in England and Wales compared to other age groups (adults aged 16 - 65 = 51.1%; elderly ≥65 = 7.2%) (Stylianou et al., 2015). It is important to note that these figures do not include those paediatric burn presentations to hospital Emergency Departments (EDs) (where the majority of children present (Davies et al., 2018) or those treated solely in the community (Burd and Yuen, 2005). These figures are therefore likely to be an underestimation of the true burn prevalence.

Acute treatment of burns presents a significant burden to the NHS in terms of cost (Pellatt et al., 2010). Griffiths et al. (2006) estimated that for a minor paediatric scald (<10% total body surface area (TBSA)) the average cost per patient to the NHS was £1,850. In 2010, Pellatt et al. estimated that acute treatment costs for major paediatric burns (30 – 40% TBSA) were approximately £63,157 (range £55,354 - £74,494) (Pellatt et al., 2010). This estimate is based on admission to the specialist service to first discharge, and established costs of theatre time, bed time, medications, fluids, dressings, invasive procedures, therapy services and investigations (Pellatt et al., 2010). As this estimation was published in 2010, it is likely that costs have risen.

Childhood burns in England and Wales are socially patterned with more burns presenting to hospital for children who live in economically deprived than not deprived areas (Hughes et al., 2013; Marsden et al., 2016). This has previously been suggested to be associated with an increased frequency and/or intensity of exposure to hazards in deprived homes and areas (Petridou and Tursz, 2001). The majority of burns that present to hospital occur in children less than five years old (Kemp et al., 2014), leading to younger children, their parents and carers being the focus of a majority of research in this area to date. However, school-aged children (5 – 16 years) are also at high risk (van Rijn et al., 1989) and constitute a larger population than the under-fives. A prospective multicentred cross-sectional study in the United Kingdom (UK) has shown that as children become older (>5 years) the injuries that predominate are scalds caused by hot water from food or domestic containers (50.3% (95% CI 42.5% to 58.1%) on the hands, arms and legs; compared to those younger (<5 years) which are mainly scalds caused by hot beverages (55% (95% CI 50.5% to 59.1%) to the face and upper trunk (Kemp et al., 2014).

1.2.1 Defining Burns

Thermal injuries, commonly known as ‘burns’, are caused by either mechanical, thermal, chemical or radiation energies. In clinical literature ‘burns’ are often referred to as ‘burn

trauma'. Burn wounds are highly variable in terms of tissues affected, severity and outcome (Evers et al., 2010). Burns are commonly classified clinically by severity in terms of the depth of the injury and proportion of body surface affected. The type of burn is often classified according to their aetiology (the agent and mechanism of causation). From this point henceforth, the term 'burns' will be used throughout the thesis to refer collectively to all thermal injuries, unless a particular burn type is being referenced (e.g. scalds).

1.2.1.1 Degree/Depth of Burn Injury

The severity of a burn relates strongly to the TBSA and depth of the injury, subsequently correlating to the extent of treatment required. Recently the traditional clinical classification model of first-, second-, third- and fourth-degree burns was replaced by a system reflecting the need for surgical intervention. Table 1 shows that cutaneous burns are now clinically classified into four groups (Superficial I, Superficial Partial, Deep Partial and Deep) according to the depth of tissue injury. The depth of the injury effects the appearance, pain level and healing time of the wound.

Table 1 - Clinical Characteristics of burn wounds of various depths (Evers et al., 2010)

Degree/Depth	Layer of skin involved	Appearance	Pain	Healing time
Superficial I	Epidermis only	Pink to red, moist, no blisters	Moderate-Severe	3-7 days
Superficial partial	Superficial (papillary) dermis	Blister, red moist, intact epidermal appendances, blanches of pressure	Severe	1 – 3 weeks, long-term pigment changes may occur
Deep Partial	Deeper layer (reticular) dermis	Dry, white, non-blanching, loss of all epidermal appendages	Minimal	3 – 6 weeks, with scars
Deep	Full thickness of skin and in to the subcutaneous fat or deeper	Leathery, dry, white or red with thrombosed vessels	No	Does not heal by primary intention, requires skin graft

Another aspect of assessment is the size of a burn wound. Size of the wound is calculated as an estimate of TBSA affected. If used correctly the Lund and Browder method is the most accurate means of measuring TBSA as it takes into consideration variations in body shape with age (Lund and Browder, 1944). The Lund and Browder chart is most commonly used in clinical practice (Figure 1) (Hettiaratchy and Papini, 2004).

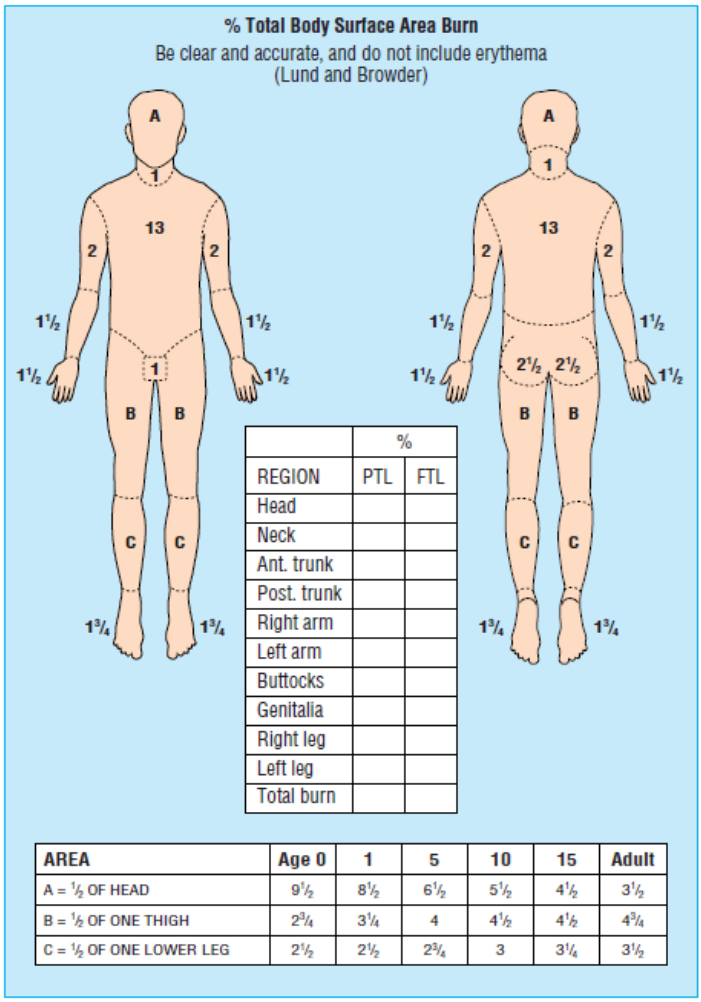


Figure 1 - Evaluation of burn wound extent using the Lund and Browder Chart (Source: Hettiaratchy and Papini, 2004)

1.2.1.2 Aetiology of Burn Injuries

The most common classification system of burn type is related to the burn aetiology. Table 2 shows the seven commonly recognised types of burn injury.

Table 2 - Burn types and their definition

Burn Type	Definition
Chemical	When the skin comes into contact with a corrosive substance such as an acid or an alkali
Contact	When the skin comes into contact with a hot object
Electrical	When an electrical current travels through the body creating entry and exit points
Flame	When the skin comes into contact with a flame
Friction	A combination of mechanical abrasion and heat generated by friction when two surfaces rub together
Radiation	When the skin is damaged due to ionizing radiation
Scald	When the skin is exposed to hot liquids or steam

As burn injuries have complex causes injury agents and mechanisms are often reported with information on severity. The 'agent' refers to the heat source, and the 'mechanism' refers to how the individual came into contact with the agent (Kemp et al., 2014). Using this level of detail when categorising and describing burn events means that a holistic picture can be developed of the injury event. A knowledge of injury agents and mechanisms can inform understanding of the size, anatomical site and depth of the burn wound. Several burn agents and mechanisms are associated with childhood burn injuries in the UK. Examples of common agents include: hot drinks; hot food; hot water; cooking appliances and hair styling devices. Examples of common mechanisms include: immersion; touch; spill; and splash. Appendix 1 contains a list of agents, mechanisms and their definitions.

1.2.2 Treatment of Burn Injuries

Dependent on the size, severity and agent, burn injuries are assessed to be either non-complex (often referred to as 'minor burns') or complex (NICE, 2017). Immediate treatment

of burn injuries is commonly separated into pre-hospital and hospital level care. Pre-hospital treatment is the conduct of first-aid, or additional medical guidance/assistance received from pharmacies and primary care. Hospital level care is any treatment received from secondary and tertiary health care services (including but not exclusive to, EDs, paediatric treatment wards, burn care services and burn care networks). In England and Wales burn care is organised in a tiered model known as the NNBC) (National Burn Care Review Committee, 2001) – the specialist service. Within the NNBC the most severely injured are treated and cared for in Burn Centres, and those requiring less intensive clinical care are cared for in either a Burns Unit or a Burns Facility (NHS Commissioning Board, 2013). Table 3 presents the stratification of the NNBC levels of service.

Table 3 - National Network for Burn Care Service Level definitions for England and Wales (Adapted from National Burn Care Referral Guidance, 2012)

National Network for Burn Care Service Level	Definition
Burn Centres	This level of in-patient care is for the highest level of injury complexity and offers a separately staffed, geographically discrete ward. The service is skilled to the highest level of critical care and has immediate operating theatre access.
Burn Units	The level of in-patient care is for the moderate level of injury complexity and offers a separately staff, discrete ward.
Burn Facilities	This level of in-patient care equates to standard plastic surgical ward for the care of non-complex burn injuries.

1.2.2.1 Management of burns in the community

Most non-complex burns (Superficial I) are managed in the community with burns first-aid treatment (BFAT) (Harvey et al., 2011). In 2014 the British Burns Association (BBA) released a first aid position statement for the standardisation of evidenced based first-aid practice throughout the UK (BBA, 2014). Table 4 contains a summary of BBA BFAT guidance (the full guidance can be found in Appendix 3). First-aid is “emergency care or treatment given

before regular medical aid can be obtained. It must be readily available, easy to use by the general public and not hinder professional examination or treatment of the wound at a later date" (Cuttle et al., 2009:769).

Table 4 - British Burn Association 'Cool, Call, Cover' first-aid advice (Adapted from British Burns Association, 2014)

Stage	Action
Cool	Cool the burn with running tap water for 20 minutes and remove all clothing and jewellery.
Call	Call for help – 999, 111 or local General Practitioner for advice.
Cover	Cover with cling film or a sterile, non-fluffy dressing or cloth. Make sure the patient is kept warm.

BFAT, when used appropriately, has the potential to improve the outcome of a burn or scald by decreasing oedema (Hudspith and Rayatt, 2004; Cuttle et al., 2009), decreasing inflammation and improving wound-healing (Ofeigsson et al., 1968; Sawada et al., 1997); leading to an improved cosmetic outcome, decreasing morbidity and providing analgesia (Nguyen et al., 2002).

Through history a range of treatments have been advocated for use in BFAT (Pinnegar and Pinnegar, 1986; Rosenberg and Mahler, 1980), however many have had little or no scientific evidence to support their use (Cuttle and Kimble, 2010). Optimum BFAT is highly contested within academic literature and varies across countries and regulatory bodies (Cuttle and Kimble, 2010; Varley et al., 2016). Historically where studies have been conducted conflicting results were found due to the use of different animal models (often rodent) and outcomes used (Cuttle and Kimble, 2010). Few studies have been conducted in larger animal models, such as pigs, which are easily translatable to humans (Meyer et al., 1978; Sullivan et al., 2001). Alongside this, studies have tested BFAT on different burns types (flame, contact and scald) with different depths of damage and examined tissue damage as the main outcome at different times post-injury (Lawrence, 1976). Current BFAT

guidance is based on data from porcine model trials. Although no model will ever completely replicate clinical human wound healing, the porcine model is an effective tool for the evaluation of therapeutic agents destined for use in human wounds (Sullivan et al., 2001).

It is well documented within the literature that cold water treatment is beneficial to the patient and the wound acutely, and can improve clinical outcomes in the longer-term (King et al., 1962; King and Price, 1963; Ofeigsson, 1959; King and Zimmerman, 1965; Wilson et al., 1963; Demling et al., 1979; Cuttle et al., 2008; Yuan et al., 2007; Boykin and Crute, 1982; Nguyen et al., 2002; Skinner and Peat, 2002; Tung et al., 2005). However, how the cold water treatment is applied, the temperature of the water and duration is continuously debated. Data using pre-clinical porcine models is recognised as most accurate and transferable to humans (Middelkoop et al., 2004; Summerfield et al., 2015). In 2007 Yuan et al. showed that applying cool running water to a burn (porcine model) for 20 minutes consistently decreased the histological depth of damage of the wound after nine days compared to applying wet towels every three minutes, spraying water every 30 seconds and an untreated control. Research has also suggested that due to seasonal and geographical differences 'cool' running water from a tap temperatures change (Cuttle and Kimble, 2010).

Porcine model research has shown that the use of water between 2°C - 15°C significantly improves the speed of re-epithelialisation of mid- and deep depth burns and can decrease the amount of scarring compared to untreated controls (Cuttle et al., 2008). Studies on cold water duration have shown that tap water treatment applied to porcine burns for 20 minutes have statistically less histological damage 9 days post-burn compared to 5, 10 and 30 minutes duration (Bartlett et al., 2008). Results from this study mirror findings from those conducted by Yuan et al. (2007) and Cuttle et al. (2009). Interestingly results also show that longer durations of cold water treatment do not provide any further clinical

benefit (Bartlett et al., 2008; Cuttle et al. 2009). Research in porcine models has also shown that applying cold water to burn wounds has a positive clinical effect up to three hours post-burn compared to untreated controls, however immediate treatment is still the most beneficial in improving burn wound outcome (Cuttle et al., 2009; Rajan et al., 2009; Cuttle and Kimble 2010).

Infection is a major complication of burn injury (NHS England, 2003). Heightened risk of infection following a burn is associated with the body's impaired resistance from disruption of the skin's mechanical integrity and general immune suppression following injury and shock (NHS England, 2003). The use of clingfilm to cover a burn wound following cold water treatment provides a non-adherent, fluid resistant and transparent dressing that reduces pain for patients from air exposure, allows for medical assessment without its removal and provides a barrier for the wound to reduce any further contact with bacteria and prevent contamination (Cuttle and Kimber, 2010; Shrivastava and Goel, 2010)). If cling-film is unavailable then current guidelines advocate the use of any clean, sterile dressing or cloth (Cuttle et al., 2010).

Other treatments commonly used in BFAT include the application of ice, wet or damp cloths and topical agents relating to folk and traditional remedies; however, these can have negative clinical effects and exacerbate the injury (Cuttle et al., 2009). Although research results are mixed on the effectiveness of ice, and studies have shown that the application of ice does not hinder clinical healing, there is concern that direct application can increase the possible adverse effect of hypothermia (Cuttle et al., 2009). Dependent on the material used there is also concern that fibres of the cloth can stick to the wound and introduce bacterium to the wound if the cloth is not sterile (St John Ambulance Association, 1969). Common topical agents applied to burns include butter, oils, ointments, milk and toothpaste and differ by culture (Cuttle et al., 2009). Most of these topical agents are based on natural products indigenous to the given geographical location that are known to have

natural healing properties (such as Aloe Vera and Tea tree) (Cuttle et al., 2009). Although many of the natural ingredients used have styptic and antimicrobial properties, they also create a non-breathable barrier between the wound and the air reducing cooling of the wound as the heat is trapped inside (Cuttle et al., 2009). This barrier is crucial within environments when there is increased susceptibility to developing an infection and reduced appropriate treatment for infections - they wanted to keep the wound away from the air and reduce the pain (The R.E.P. Book, 1903; Martin, 1886). However, due to medical advancements a majority of infections can readily and effectively be treated with the appropriate medical infrastructure and containing the heat in the wound through the use of natural plant-based ointments and oils can exacerbate the injury (Martin, 1886; Cuttle et al., 2009).

1.2.2.2 Burns first-aid knowledge of parents and students

Two research studies with parents in the UK have demonstrated that parents have inadequate knowledge of BFAT (Graham et al., 2012; Davies et al., 2013). Graham et al. (2012) interviewed parents attending hospital outpatient appointments asking what first-aid they would provide for a child with a large scald (n = 188). Results report that 10% would give ideal first-aid (ideal first-aid consisted of stating that they would complete the following steps: 1. remove clothes and jewellery 2.run under cold water for 10 – 20 minutes or until discussed with emergency medical service 3. seek help from healthcare professionals 4. dress the wound with plastic food wrap or clean cloth). Further results report that although 73% of parents (n = 137) would run the burn under cool water, only 35% (n = 66) would cool the burn for an adequate length of time. Davies et al (2013) assessed parent BFAT knowledge through a questionnaire administered in a hospital emergency and antenatal department (n = 106). Study results report that 32% of parents had adequate knowledge of BFAT (adequate knowledge was assessed as applying water for

10 – 20 minutes and covering with cling film, water for over 5 minutes and covering with cling film, water for 10 – 20 only or applying a specialist burn shield dressing), whilst 43% (n = 46) (had poor or no knowledge (poor = water for 1 minutes, application of a generic burn cream/spray only, application of any inappropriate treatment or cling film only. No knowledge = would not do anything or any contraindicated treatment). During this study parents were also asked if they had undergone any first aid training, of the 40% (n = 45) of parents who had, 74% (n = 33) had adequate knowledge. Ordered logistic regression models with BFAT knowledge as outcome were conducted showing that previous first-aid training was the most significant factor in predicting the probability of having adequate knowledge of BFAT ($p < .001$) (other explanatory variables were: gender, age, education and SES).

In 2006 in Cambodia Hsaio et al. assessed BFAT knowledge level of students (n = 420, average age 12.5 years). Results from this study report that only 13% of students mentioned that they would apply water to the wound immediately; the most common answer was to apply toothpaste (18%). To the author's knowledge, no further studies have assessed school-aged students' knowledge of BFAT exclusively.

These studies suggest that there is a need for education to address the lack of knowledge on appropriate BFAT skills among parents in the UK population. Results report that previous first-aid training is the most significant factor for correct BFAT knowledge, therefore it is hoped that BFAT training may lead to an increase in knowledge and administration of correct BFAT so that clinical outcomes are improved.

1.2.2.3 Hospital Management of Burns

Due to the nature of burn injuries hospital management is necessary for complex burns (often those classified to be superficial partial, through to deep).

As noted in section 1.3.3, dependent on severity of injury, patients are referred to Burns Centres, Burns Units or Burns Facilities within the NNBC. In 2012 the NNBC released referral guidance to standardise patient referrals dependent on severity. Referral decisions consider: TBSA, depth, anatomical site, mechanism and other factors (including parameters that may impact on the severity/complexity of burn injury) (National Network for Burn Care, 2012). Table 5 reports the suggested minimum threshold for referral into specialised burn care services as summarised within NNBC guidance. Appendix 2 contains further information on the thresholds outlined in the guidance on the referral paediatric burns services.

Table 5 - The suggested minimum threshold for referral into specialised burn care services across England and Wales (Adapted from: National Network for Burn Care Referral Guidance, 2012)

The suggested minimum threshold for referral into specialised burn care services can be summarised as:
All burns ≥2% TBSA in children or ≥3% in adults
All full thickness burns
All circumferential burns
Any burn not healed in 2 weeks
Any burn with suspicion of non-accidental injury should be referred to a Burn Unit/Centre for expert assessment within 24 hours

Burn injuries produce complex physiologic responses within the body, especially within the skin and adjacent tissue. If the burn injury is over 30% TBSA inflammatory and toxic responses can cause cardiovascular, respiratory, metabolic and immunological changes (Hettiaratchy and Dziewulski, 2004). Emergency and short-term management of complex burn injuries can include fluid resuscitation, wound cleaning, debridement (the removal of dead, damaged or infected tissue), blister management, wound dressing and continuous reassessment (Hettiaratchy and Papini, 2004; NICE 2017). Long-term clinical management

and treatment changes focus to rehabilitation and cosmetic outcomes including itch, scarring, pigmentation and psycho-social sequelae (NICE, 2017).

1.2.3 Physical and Emotional Outcomes of Burns

Outcomes of burn injuries depend upon prompt and optimal treatment related to TBSA, burn depth, anatomical site, patients age and associated co-morbidities (NICE, 2017). Whilst burns treatment has improved (NHS, 2013) and is delivered by the NNBC long-term outcomes of burn injuries can include physical and disfiguring impairments leaving individuals with sub-optimal functioning and emotional consequences that can have negative effects on several psycho-social dimensions (Peleg et al., 2011; van Barr et al., 2011).

Common and clinically significant physical impairments include: contractures (the shortening or stiffening of muscles, skin or connective tissues surrounding the wound leading to decreased motion and deformities), increased catabolism with loss of lean body mass (leading to overall weakness and reduced functional ability), issues with thermoregulation (affecting the ability to complete physical activity and be in hot environments), amputations, neuropathy (damage to the nerves that can affect senses such as ability to feel pain, detect changes in temperature or having a constant feeling of tingling or numbness), pruritus (chronic itching of scars) and chronic pain (Esselman, 2007). Emotional and psycho-social impacts can include posttraumatic stress, altered body image, social functioning challenges, emotional functioning challenges and reduced quality of life (Sheridan et al., 2000; Corry et al., 2009; Landolt et al., 2009). When combined these long-term outcomes often limit individual's chances of living a normal, economically productive life, free of stigma and restriction in participation to society no matter where they come from in the world (WHO, 2008).

Previous research has shown that following burn injuries parents and family members of the child can develop psychological symptoms including guilt, depression, anxiety, hostility and posttraumatic stress (Byrne et al., 1986; Cella et al., 1988; Mason and Hillier, 1993 a & b; Mason, 1993; Kent et al., 2000; Hall et al., 2006). Even relatively small and less severe burn injuries can have significant physical and psycho-social consequences for the child and the family.

1.2.4 Risk Factors for Childhood Burn Injury

A number of risk factors have been found to be associated with burn injury. These risk factors are multivariate and interrelated (Peck, 2011). Injury risks are commonly discussed within the conceptual framework of the events surrounding the injury and the classic epidemiological parameters of host, agent and environment (Baker, 1975; Rivara and Mueller, 1987).

1.2.4.1 Host and Hazard

Important host characteristics for childhood burn injury include gender and age, and important hazards characteristics include injury agents and mechanisms (Rivara and Mueller, 1987).

The impact of gender on the risk of childhood burns is varied within the literature. Around the world men and women, boys and girls, are exposed culturally to different hazards at different points in their lives. In the UK exploratory and risk-taking behaviours are more prevalent in boys (Morrongiello et al., 2006; Kai-Yang et al., 2008; Towner and Mytton, 2009). The Hughes et al. (2013) study exploring burn injuries presenting to EDs in England (attendances April 2010 – March 2011, n = 22,222) showed a higher proportion of males aged 0 – 14 years at 53.2%; present with a burn injury than females a male: female ratio of 1.14:1 ($p<.001$). As all data in this study were grouped (ages 0 – 14 years together) for analysis by gender further inferences cannot be made for different age-groups by gender.

A study by Emond et al. (2016) using data from The Avon Longitudinal Study of Parents and Children provides more insight into the influence of gender by age for burn injuries. Boys were more likely to sustain a burn between birth and 2 years (boys incidence rate 81.1 per 1000/year, 95% CI 75.4 – 87.1) than girls (62.1, 95% CI 57.0 – 67.6); there was no statistical difference between boys and girls aged 2 – 4.5 years (boys 43.7, 95% 39.9 – 47.8; girls 40.6, 95% CI 36.8 – 44.7); and girls were slightly more likely to sustain burn injuries by point estimate when school aged (5-11 years) (boys 12.9, 95% CI 11.4 – 14.6; girls 15.7, 95% CI 13.9 – 17.5) though confidence intervals show no different. These results suggest that gender risk may differ across age groups. However, these results should be interpreted with caution as these data are now 16 years old and burn agents can change over time.

The highest prevalence of paediatric burns that present to hospital is for those less than five years in the UK (Rawlins et al., 2007; Kemp et al., 2014; Baker et al., 2016; Battle et al., 2016). However, school-aged children (5 – 16 years) are also at high risk (van Rijn et al., 1989) and constitute a larger population than the under-fives. In general, age, as a risk factor of burn injury, is associated with the child's developmental stage, rather than their chronological age. As developmental stage progresses, and children become more mobile, children are at risk of burn injuries and therefore patterns in burn aetiology change. A prospective multi-centred cross-sectional study of children aged less than 16 years was conducted on data from EDs and BUs across Wales, England and Ireland on data collected between July 2008 and December 2010. Analyses for those children aged over five years within the study (n = 155) show that as children become older there is a higher prevalence of scalds (relating to spills of either hot beverages, domestic water and food items), causing injury to the hands, arms and legs. Contact burns (relating to touching portable and fixed household agents) could also be more likely to occur as children become involved in food preparation and domestic chores. An increase in contact and flame burns are also reported

and could be related to an increase in high risk behaviours with outdoor agents such as fireworks, barbecues and motorcycle exhausts (Kemp et al., 2014) in early adolescence. Compared to burn injuries in those aged less than five, little is known about current patterns of injuries to school-aged children and whether they have changed since the Kemp et al. (2014) paper. To address this gap in the literature, I present a descriptive analysis of cross-sectional data of school-aged children presenting to EDs, minor injury units and BUs across England and Wales in chapter two of this thesis.

1.2.4.2 Environment

Important environment characteristics for childhood burn injury include the socioeconomic environment, the physical environment, and the legislative environment (Rivara and Mueller, 1987). Research has shown that SES is a risk factor for childhood burn injury within the UK (Hughes et al., 2013; Marsden et al., 2016). Hughes et al. (2013) conducted a cross sectional analysis of ED attendance in England for key injury types for children aged 0 – 14 years between April 2010 and March 2011. Within this time-period there were 22,222 burn injuries that presented to ED. SES for patients was apportioned according to patient postcodes and the Index of Multiple Deprivation (IMD) score at the lower super output area (LSOA) level. IMD is a composite measure of area-level deprivation incorporating 38 indicators, providing a quintile of I to V for relative deprivation (I being the lowest, and V being the highest) (Department for Communities and Local Government, 2011). The proportion of burn injuries was shown to increase by quintile (I = 13.6%, II = 15.6%, III = 18.9%, IV = 22.8%, V = 29.1%). The ratio of burns presenting to ED between children from the poorest and richest (quintile 5:1) was 2.14:1 ($p<.001$), suggesting that children from quintile five (the most deprived) were more likely to present to an ED in England with a burn injury than those from quintile one (the least deprived areas area).

An analysis from Abertawe Bro Morgannwg University Health Board, in Wales on burn injuries presenting to the ED between June 2005 and April 2014 showed that 2,094 patients

less than 16 years of age attended ED with a burn injury; of which of which 278 were admitted (Marsden et al., 2016). The proportion of burn injuries presenting to the ED was shown to decrease by quintile (with quintile I being the most deprived, and quintile V being the least) (I = 36.2%, II = 20.8%, III = 18.5%, IV = 10.3%, V = 14.2%). Those aged 16 years or younger and in the most deprived social group were at increased risk of burn injury compared to those in other age groups and in less deprived social groups (OR 1.23, 95% CI 1.06 – 1.44). The association between SES and burn injury may be explained by a greater exposure to burn hazards in children who live in socioeconomically deprived areas (Petridou and Tursz, 2001). Examples of hazards include more exposure to smoking and alcohol, living in poor quality over-crowded housing and being from single parent families (Marsden et al., 2016). Increased use of alcohol and being from single parent families increase burn risk through exposure to hazards due to less frequent or appropriate supervision (Marsden et al., 2016).

1.3 Current Knowledge of Burden of Burn Injury

Unfortunately, there is sparse current epidemiological knowledge and available data for childhood burns. Alongside previous epidemiological studies (such as Kemp et al., 2014, further discussed in chapter two) currently the only available open access data in the UK is based on hospital administrative data sets reporting hospital episode statistics. Hospital episode statistics are reported yearly for England (Hospital Episode Statistics (HES)) and Wales (The Patient Episode Database for Wales (PEDW)), containing all inpatient and day case activity undertaken in the NHS. Episodes are reported within the database according to their International Classification of Diseases Code 10th Revision (ICD-10). ICD-10 diagnosis codes T20-T33 are all the codes associated with burns and corrosions. These codes can be further broken down to provide additional information on primary body site affected. HES data from 2017/2018 report 5,553 burn incidents to children aged 0-14 years old (HES, 2018), for the same time period PEDW data report 238 incidents to children of

the same age-group (PEDW, 2018). Due to the format of data provided gender split of incidents cannot be attributed, and when broken down further to primary site of diagnosis there is a lot of missing data. HES data for 2017/2018 report the highest incidence of burns to children aged 0-14 years occur to the wrist and hand (n = 1290), whereas PEDW data report highest incidence for the same age-group to the head and neck (n = 27). Due the level of missing data and inconsistences it would be inappropriate to place any meaning or emphasis on these figures – though currently they are all we have.

Previous studies and assessments from reports of hospital episode statistics have encountered similar issues with accuracy and this suggest caution with interpretation (Sinha et al., 2013; Thorn et al., 2016). It is suspected that the figures presented are a large underrepresentation of incidence of burn injury for children in England and Wales; especially when taken into consideration that this does not include any burn injuries that occur, but do not present to NHS services at the hospital level (treated in the community or in GP practices). Therefore, we do not know the current accurate burden of disease of childhood burn injury to the population within the UK.

In 2004 the UK National Burn Care Group funded the creation of the UK National Burn Injury Database which included the creation of the International Burn Injury Database (iBID) data collection system and the infrastructure to support it (iBID, 2017). The premise of iBID was to support collection of data to inform understanding of pattern of injury, clinical outcomes, treatments and prevention. To date data is only collected from England and Wales, and the last descriptive analysis report of the data was published in 2015, from data collected 2003-2011 (Stylianou et al., 2015). Data from this study and others that are similar are discussed in detail in chapter two. Results from these studies are currently the best data we have on the epidemiological patterns of burn injury in the UK, though unfortunately they are now dated. Therefore, there is a dearth of knowledge in this arena to inform evidence-based prevention efforts. In recognition of this an epidemiological

study has been conducted and is reported in chapter two of this thesis to shed light on burn injury patterns for children in the UK.

1.4 Burns Resulting from Maltreatment and Unintentional Burns

Although it is not the topic of this thesis specifically, it is important to recognise those burns occurring as a result of maltreatment. Maltreatment includes both neglect (from inadequate supervision) and physical abuse. Whilst unintentional injuries predominate, international estimates suggest that 10-25% of paediatric burns result from maltreatment (Chester et al., 2006; Ojo et al., 2007; Thombs et al, 2008; Wibbenmeyer et al., 2014; Bousema et al., 2016), with a greater number attributed to neglect than physical abuse by as much as 9:1 (Maguire et al., 2014). From this point henceforth, all data and discussion will be in relation to burn injuries of an unintentional nature and the term 'unintentional' will be used to illustrate this where appropriate.

1.5 Injury Prevention

Although burn injuries are common, they are preventable (Verey et al., 2014; Mondozzi and Harper, 2001; Atiyeh et al., 2009; Edelman, 2007). The primary aim of injury prevention is to reduce occurrence of injuries caused by external mechanisms, and secondly to reduce injury severity. Prevention interventions are defined as "a strategy or series of strategies that are implemented with the goal of preventing, reducing, or ameliorating injuries" (Doll et al., 2007:22). Preventative interventions can include products, environmental changes, behavioural, educational and communicative interventions, policy guidelines and legislation (Doll et al., 2007).

1.5.1 Existing burn injury prevention

Previous research has shown that in localities where burn prevention programs do exist, they are effective in reducing burn-related hospitalisations (Peleg et al., 2005). However,

most burn prevention interventions in the UK have addressed burn injuries for children less than five years of age and therefore target parents. Of those that have addressed the school-aged population, they have often been targeted at reducing sunburn or sun damage explicitly, or not conducted in the UK.

In 2016 a Cochrane review by Orton et al. explored the prevention of unintentional injuries for children and young people through school-based education programmes. The objective of the review was to assess the effects of school-based education programmes for the prevention of injuries in children and evaluate their impact on improving safety skills, behaviour, practices and knowledge and assess their cost-effectiveness. The review identified 27 studies (from 30 publications) that met their search criteria; 27 studies were included in a qualitative synthesis and 3 in a meta-analysis. Two studies reported specifically on burn safety knowledge (Carmel et al., 1991; Grant et al., 1992) and six covered either burn safety or sun safety as a component within interventions that covered multiple injuries (Frederick et al., 2000; Lu et al., 2000; Campbell et al., 2001; Azeredo and Stephens-Stidham, 2003; Kendrick et al., 2007). Intervention components consisted mainly of lessons (Carmel et al., 1991; Grant et al., 1992; Morrongiello et al., 1998; Frederick et al., 2000; Lu et al., 2000; Campbell et al., 2001; Azeredo and Stephens-Stidham, 2003; Kendrick et al., 2007) (some using multi-media components) (Carmel et al., 1991; Morrongiello et al., 1998; Frederick et al., 2000; Lu et al., 2000; Kendrick et al., 2007) some having additional materials provided to take home (Azeredo and Stephens-Stidham 2003), safety pen pal letters (Azeredo and Stephens-Stidham 2003), outreach activities for parents (including letters and meetings) (Lu et al., 2000; Azeredo and Stephens-Stidham 2003), homework exercises (Campbell et al., 2001) and a site visit (Frederick et al., 2000). Studies included three randomised control trials (RCT) (Carmel et al., 1991; Grant et al., 1992; Campbell et al., 2001) one cluster RCT (Kendrick et al., 2007), and four controlled before and after studies (CBA) (Frederick et al., 2000; Lu et al., 2000; Azeredo and

Stephens-Stidham 2003; Morrongiello et al., 2008). Outcomes ranged from observations on safety practices and behaviours to self-report behaviours, safety knowledge measures, scenario assessments and cost-benefit analyses. All studies included in the review were assessed as being high or unclear risk of bias across multiple domains (n = 27). The review concluded that school-based educational programs may improve students' safety knowledge, skills and behaviour, but there is currently insufficient evidence to determine whether school-based education programs can prevent unintentional injuries. They also highlighted the need for more high-quality studies.

As it stands the Cochrane Review completed by Orton et al. (2016) is the best critical assessment of the effectiveness of school-based education programs for the prevention of injuries to date. However, due to the exclusion of studies where interventions targeted a single injury type or mechanism (such as interventions addressing only burns, or only scalds or contact burns), those that did not contain a school-based component, or where the intervention was delivered in a community setting (such as youth clubs or social clubs), studies reporting evidence of the effectiveness of interventions for the school-aged population could have been missed. The type and severity of burns can change over time and context. New burn hazards emerge, for example the increased use of hair styling devices and e-cigarettes (Duncan et al., 2006; Colaianni et al., 2016; Roger et al., 2016; Johnson et al., 2017). Therefore, preventative intervention measures need to react to these changes as legislative, environmental and engineering interventions may be impossible to design and take too long to change and implement (Hettiaratchy and Dziewulski, 2004b). To address this gap, I present a systematic review assessing what interventions prevent unintentional burns and scalds for school-aged children in chapter two of this thesis.

1.5.2 Using the school for prevention delivery

The school setting is an excellent location for the delivery of public health preventative interventions at the scale to derive population-level change (Denman et al., 2002;

Dewhurst et al., 2014), as teachers are part of the wider public health workforce (Department of Health, 2013). In 2003 the World Health Organisation (WHO) published a report titled 'Improving Health Through Schools' and set a precedence for the utilisation of schools as a setting for health promotion; and so was the advent of the health-promoting school. Using the school as a setting for burn prevention and BFAT has precedence as a way of directly reaching those aged 4 – 16 years at risk of burns (Ghosh and Bharat, 2000). In the UK attendance at school is not mediated by SES and thus a universal school-based intervention should yield high returns across all SES groups if administered affectively (Bartfay, 1994; Mondozzi and Harper, 2001).

1.6 Medical Research Council Guidance for Developing and Evaluating Complex Interventions

As has been shown burns are complex injuries that occur in complex systems. Therefore, prevention of such injuries requires complex interventions that take into consideration the social, cultural, physical and behavioural environment in which burn injuries occur. To do this, the thesis will follow the methodology of the first two stages of the Medical Research Council (MRC) developing and evaluating complex interventions: Intervention development and Feasibility/Piloting Testing (Craig et al., 2008). Figure 2 shows the key elements of the development and evaluation process as laid out by the guidance.

Figure 2 - Key elements of the development and evaluation process (Craig et al., 2008)

As recommended in the MRC guidance, the evidence base will be identified using a systematic review of the effectiveness of existing interventions in preventing burn injuries to school-aged children. To examine the characteristics of participants, agents and mechanisms of injuries an epidemiological study will be conducted. Using this information, I will design a logic model for a new intervention showing the inputs, activities, outputs, casual mechanisms, outcomes and assumptions. A mixed methods feasibility study will then be conducted to assess the feasibility and acceptability of the intervention and to assess causal mechanisms and assumptions within the logic model. Results from the feasibility study will be discussed in relation to the existing literature, implications of the

work to policy and practice and suggestions for refinement of the intervention and further research.

1.7 Aims and Objectives

The aim of this thesis is to examine the epidemiology (patterning, mechanism and agents) of burns in school-aged children and systematically review the effect of school-based burn prevention interventions to inform the design of a school-based burns prevention and first-aid intervention. The acceptability, feasibility and potential effect of this intervention will be tested.

This thesis will achieve this aim through the following objectives:

1) To conduct an epidemiological study to understand what injury events are occurring to school-aged children within the UK, and the first-aid treatment that they receive prior to presentation for formal medical assistance;
2) To conduct a systematic review on what burn prevention interventions prevent unintentional burns for school-aged children;
3) To develop a school-based burns prevention and first aid intervention program;
4) To conduct a study to assess the feasibility of a school-based burns prevention and first aid intervention program.

1.8 Chapter Summary

School-aged children have little knowledge of childhood burn risks and hazards, and little knowledge of appropriate BFAT to perform if injuries do occur. Previous research has identified the debilitating physical and psycho-social outcomes that can occur from burn injuries that can stay with children for life. Therefore, there is a need for interventions for the school-age population. Previous research has suggested that school-based educational interventions can improve students' safety knowledge, skills and behaviour. However, to develop an effective intervention tailored for the population, the current aetiological patterns of injury must be well understood, alongside the social, cultural and economic

factors that can contribute to burn causation. Lessons can be learnt from previous research in this field, and improvements made. To this end a school-based burns prevention and first-aid program will be developed following the MRC developing and evaluating complex interventions guidance (Craig et al., 2008).

Chapter Two - Patterns of unintentional burns in school-aged children: a cross-sectional study

2.1 Chapter Introduction

This chapter describes a cross-sectional study to examine the patterns of burns of school-aged children presenting to EDs, minor injury units and BUs across England and Wales. These analyses will be used to inform the development of a school-based burns prevention and BFAT intervention. Specifically, these data will enable the intervention to be targeted at the highest risk age group, agents and mechanisms of burn injuries.

2.2 Background

The majority of research on childhood burns has used hospital inpatient data which only captures the most severe injuries (Burd and Yuen 2005, Tung et al. 2005, Ho and Ying 2001, Mercier and Blond 1996). It is known that the highest incidence for burns is for those less than five years of age (Kemp et al., 2014, Zhou et al., 2014, Goutos and Tyler 2013); this has led to younger children, their parents and carers being the focus of the majority of epidemiological research to date. However, school aged-aged children (aged 5-16 years of age) are also at high risk (van Rijn et al., 1989) and constitute a larger proportion of the population than those less than five-years-old. Relatively little is known about the factors which contribute to the severity of burns in this population (Hsiao et al., 2007; Burd and Yuen 2005). Two previous studies have examined factors that influence the severity and pattern of burn injuries (Kemp et al., 2014; Abeyasundara et al., 2011).

Results from the Kemp et al. (2014) study reported on 155 school-aged children (5 - 16 years) which is a small representation of the overall sample (n = 1215). This is not surprising

when prevalence of burns for those less than five years is taken into account, however to explore patterns of injury this is a small sample. Due to the small sample analysis ages were grouped for all analysis above the age of five (5 - 16 years together). Although this study provides vital information on the patterns of burns to school-aged children in England and Wales, it is likely that patterns of burns are not consistent across that age-range as children engage in different behaviours at different ages thus exposing themselves to different burn hazards. Abeyasundra et al. (2011) conducted a retrospective review of 3,621 children who were treated in the BU (both ambulatory and inpatients) in New South Wales, Australia between January 2003 and December 2007. Similarly data from this study provided vital information on the patterns of burns to school-aged children, however data are over ten years old now, and burn aetiology may differ between the UK and Australian population thus placing the generalisability of this data into question.

The majority of research on burns first-aid for children in the UK has centred on assessing and exploring first-aid knowledge of parents/carers (Graham et al. 2012, Davies et al. 2013). Studies report that between 10 – 32% of parents reported took 'ideal first-aid steps' or had 'adequate knowledge' of burns first-aid in-line with their assessment criteria. Evidence from other developed countries suggests that between 22 – 40.5% of paediatric burn injuries receive 'adequate' first aid prior to presentation to medical services in accordance with best practice BFAT guidelines (McCormack et al., 2003 (AUS); Skinner and Peat. 2002 (NZ)). Although this data provides us with an idea of population knowledge it does not examine incidence of application and there is no existing evidence for knowledge of school-aged children.

2.3 Aim

The aim of this study is to describe the pattern of burn injuries sustained and first-aid treatment received by school aged children (5 – 16 years) who present to an emergency department, minor injury unit or burns unit in the UK.

2.4 Methods

The Scar Free Foundations Centre for Children's Burns Research Database (CBRD) holds demographic (age, gender and impairments (behavioural, learning, motor, neurological, hearing, vision)), injury (type of injury, agent (Appendix 4), mechanism (Appendix 5), total body surface area affected (TBSA), injury depth, (TBSA and burn depth as estimated by clinician) body site affected (as drawn on body map (Appendix 6), when and where the injury occurred and an open text explanation of the injury event) and first-aid information (treatment and duration provided prior to presentation) for all scalds and burns presenting at Emergency Departments (ED), minor Injury Units (MIUs) or Burn Units (BUs) across contributing 17 sites in England and Wales, United Kingdom.

Data obtained from the CBRD were collected in EDs, MIUs and Paediatric BUs across six UK centres (Cardiff, Bristol, North Manchester, Birmingham, Swansea and Wrexham) between January 2013 and April 2017. Individual sites included 11 EDs (University Hospital of Wales Paediatric, Bristol Royal Hospital for Children, Bristol Frenchay, North Manchester General Hospital Paediatric, Royal Oldham Hospital, Rochdale Infirmary, Morriston Paediatric, Birmingham Children's Hospital, Wrexham Maelor Hospital, Ysbyty Gwynedd, Glan Clwyd) three MIUs (Barry MIU, Rochdale Hospital Urgent Care Centre, Southmead MIU) and three BUs (Barbara Russell Children's Unit, Birmingham Children's Hospital Burns Unit and Morriston Burns Unit).

Data were collected using the Burns and Scalds Assessment Template (BaSAT) Version 4, 5, 6 and 7 (Appendix 7, 8 & 9). The BaSAT is a standardised assessment template that is completed by the examining clinician upon presentation for all children (<16 years of age) with a burn. The BaSAT acts as a clinical record assembling detailed information on the injury, extent of the injury and the injury event. Information includes history and characteristics of the injury, details of the child, referrals and outcome questions for those

injuries that raise a concern of abuse or neglect. All clinicians working within a centre taking part in the study receive training in the completion of the BaSAT.

Burns were defined according to the type of thermal injury including: scalds, contact burns, radiation burns, flame burns, chemical burns, friction burns, and aerosol burns. Injury agent categories included: hot drink, hot food, hot water, cooling appliances/oven, hair styling devices, iron, radiator, aerosol, sun, fireworks, vehicle exhausts, petrol, outdoor heat/fire source, other. Injury mechanism categories include: immersion, touch, spill, fell/ran into, pull down, splash, exposure to sun, spray, explosion, other, not known, missing. Burn type, agent and mechanism categories were based on those used within the Kemp et al. (2014) study.

Clinicians record the burn depth and according to the portion of the burn that is of superficial partial thickness or worse on the BaSAT, as well as this TBSA. Figure 3 demonstrates the categorisation of body sites as used in the BaSAT. Clinicans indicate on the image site of injury. Body areas affected were categorised into seven zones: head, neck and face; shoulder and upper arm; lower arm and hand; torso; back; upper leg and know; lower leg and foot (Appendix 6).

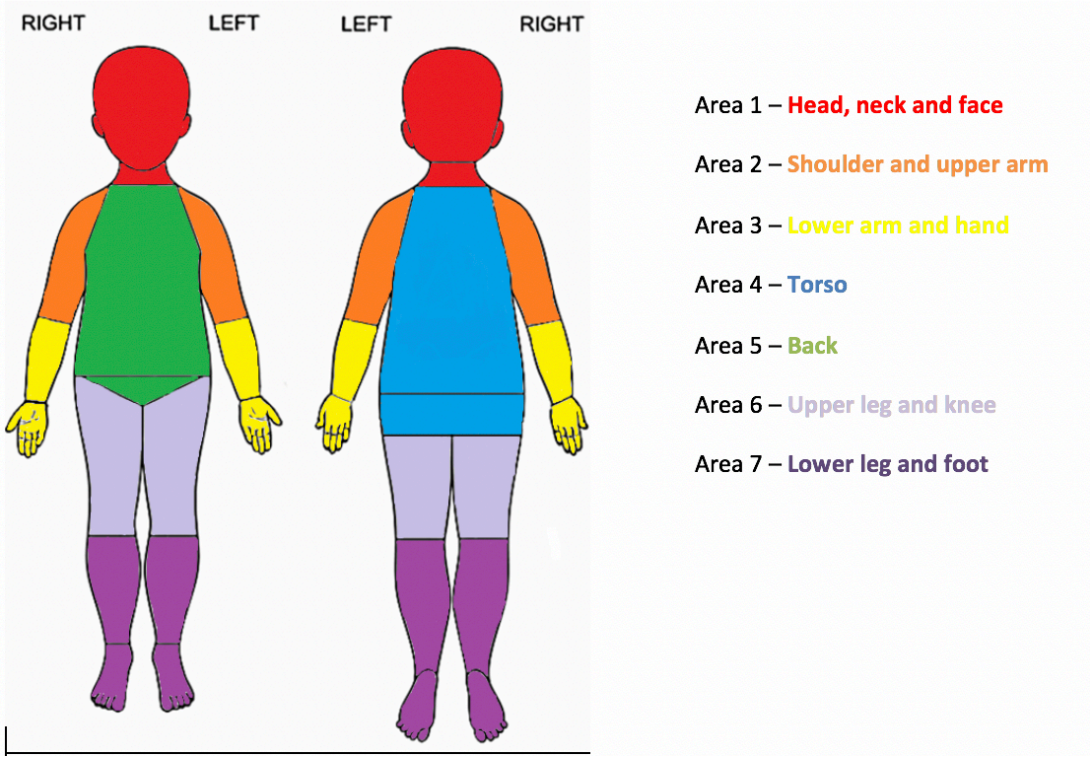


Figure 3 - Body Map as used in the BaSAT and categorisation of body site effects by burn injury in the Children's Burns Research Network Database

Data on developmental or behavioural impairments were self-reported by the parent/carer. Previous impairments were split into six categories: behavioural, learning, motor, neurological, hearing, vision. Where children had more than one impairment all were recorded. Data were recorded on the time of presentation to the medical centre, and the time that the injury occurred was recorded. For analysis, time was rounded to closest complete hour (out of 24) and categorised into the following for analysis: morning (7 – 10am), lunch (11am – 1pm), afternoon (2 – 5pm), evening (6 – 9pm) and night (10pm - 6am). Seasons were defined as: Spring = March, April May, Summer = June, July, August, Autumn = September, October, November and Winter = December, January and February. Whether first-aid was appropriate was defined as being in line with the British Burns Associations (BBA) first-aid for burns position statement (2014) (Appendix 3). Appropriate

first-aid is categorised by the BBA as cooling with cool running water for 20 minutes and covering with a Clingfilm or sterile non-fluffy dressing.

Case notes were anonymised, and data were compiled into a Research Electronic Data Capture database (REDCap). Data for those aged 5 – 15 completed years were exported into SPSS v20 for analysis (IBM Corp, Armonk, New York). Cases were removed from analysis when the injury was intentional, when the age was over 15 years and when either gender or injury type were missing. Only incident injuries are included (i.e. when the patient presented with the burn injury the first time); no follow-up visits or admissions for further treatment related to the same burn injury were included.

2.4.1 Statistical methods

All data were analysed using descriptive statistics, and where appropriate 95% confidence intervals of proportions are provided. Where percentages are presented these have been rounded to one decimal point. For estimates of incidence, injury type, agent and mechanism, chi-square tests were conducted to assess whether injury type, agent, mechanism, TBSA, injury depth, injury location, time of day the injury occurred, day of the week and season that the injury occurred and first-aid delivery were statistically different by age group. If the assumptions for the Chi-square test were not met, then the Fisher exact test (Exact Sig. 2-sided) was used. For all other analyses data were analysed by age group (5 – 7, 8 – 10, 11 – 13 and 14 – 15 years). A series of chi-squared comparisons were conducted with the largest age group (5 – 7 years, n = 335) acting as the reference category. Where a variable had more than eight categories, any of those contributing less than four percent of the entire sample (n = 43) (combined across all four age groups) were amalgamated into one 'other' category due to the low number for analysis. Appendix 10 provides further detail of the amalgamations.

Ascertainment rates were calculated as a proportion of those patients for whom a BaSAT was completed from all those eligible presenting with a burn over the study period in each

site respectively. Where data were unavailable approximate figures from centres were provided following discussion with the principle investigator of the given centre.

2.5 Results

Data were collected across the six centres between 2013 and 2017. Dates of data collection per site were as follows:

- Cardiff and Bristol between January 2013 – April 2017 (with a one-month break in Bristol (May 2014) due to a change in hospital site);
- North Manchester January 2015 – April 2017;
- Wrexham March 2016 – April 2017;
- Swansea April 2016 – April 2017;
- Birmingham October 2016 – April 2017.

The number of contributing cases by site is reported in Appendix 11. Ascertainment rates varied between 45-100% across different centres, with an average of 77% (Appendix 11). Between 2013 and 2017 1,100 children presented with burn injuries to these centres. Of these, 1,084 (98.5%) were included in the analysis. Sixteen cases were excluded from analysis for the following reasons: non-accidental injury (0.5%, 5/1,100), being 16 years old (0.4%, 4), gender missing (0.5%, 5) and injury type missing (0.2%, 2).

2.5.1 Sample Characteristics

The mean age was 9.7 years (SD 3.2, Median 10, range 5 – 10) (Figure 1, Appendix 12), 51.2% were female (Appendix 12) and impairment was recorded in 5.8% of all children; the most frequent of which were behavioural (Appendix 13 & 14).

The peak incidence for injuries occurred in the five-year-olds at 12.1% (95% CI 10.3% to 14.2%) of all cases; followed by eleven-year-olds at 11.4% (95% CI 9.7% to 13.5%) and six-year-olds at 10.4% (113, 95% CI 8.7% to 12.4%) (Appendix 12). The 95% confidence intervals for the incidence of burns indicate there was no statistically significant differences in incidence by age.

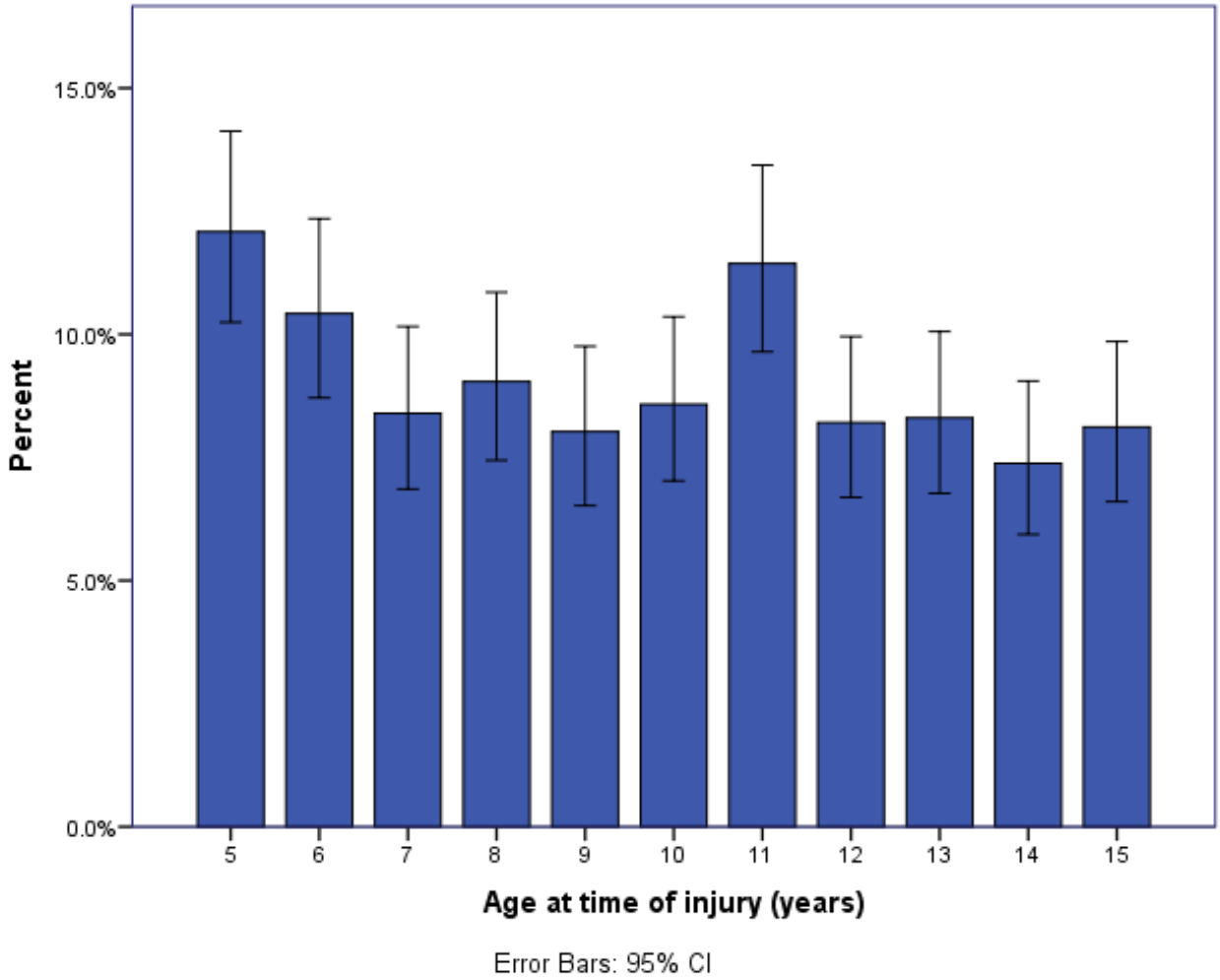


Figure 4 - Percentage (95% confidence interval) of burns from the Children's Burns Research Database for 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham] by year of age (n = 1,084)

Across 1,084 participants, 1,285 body sites were affected (Appendix 15), with 18.3% of all participants sustaining an injury to more than one anatomical site (Appendix 15). The most frequent injury sites were the lower arm and hand across all age groups at 38.8% of all injuries (Appendix 16). The second highest was the upper leg and knee for all age groups (8 – 10, 14.3%, 48/336; 11 – 13, 13.4%,49/366 and 14 – 15, 12.8%, 25/195) apart from those aged 5 – 7 years where the lower leg and foot were involved in 34.3% (57/388) (Appendix 16).

The majority, 57.1% (619/1084) of injuries were ≤ 1% TBSA across all ages and age groups, 17.0% (184) of children had burns of 2 – 9% TBSA (Appendix 17). Data show no significant differences between age groups for TBSA (Appendix 17). However, it should be noted that data on 20.5% (222) of cases were missing for this variable.

Partial thickness (wet/pink injuries) were the most frequent injury depth across all ages and age groups at 47.9%, followed by partial thickness (broken skin, wet/pink) at 22.9% (Appendix 18). There were no significant differences between age groups for injury depth (Appendix 19).

2.5.2 Type of burn

The most frequent burn injury type was scalds at 49.1%, followed by contact 34.3%, flame 5.0%, radiation/sunburn 4.5%, chemical 3.4%, explosive 1.5%, electrical 1.3%, and friction 0.9% across all ages (Appendix 20). When analysed by age-group those aged 8 -10 years, 11 – 13 years and 14 – 15 years sustained significantly different type of burns compared to those aged 5 – 7 years (Fisher's Exact, p <.001) (Figure 6, Appendix 19).

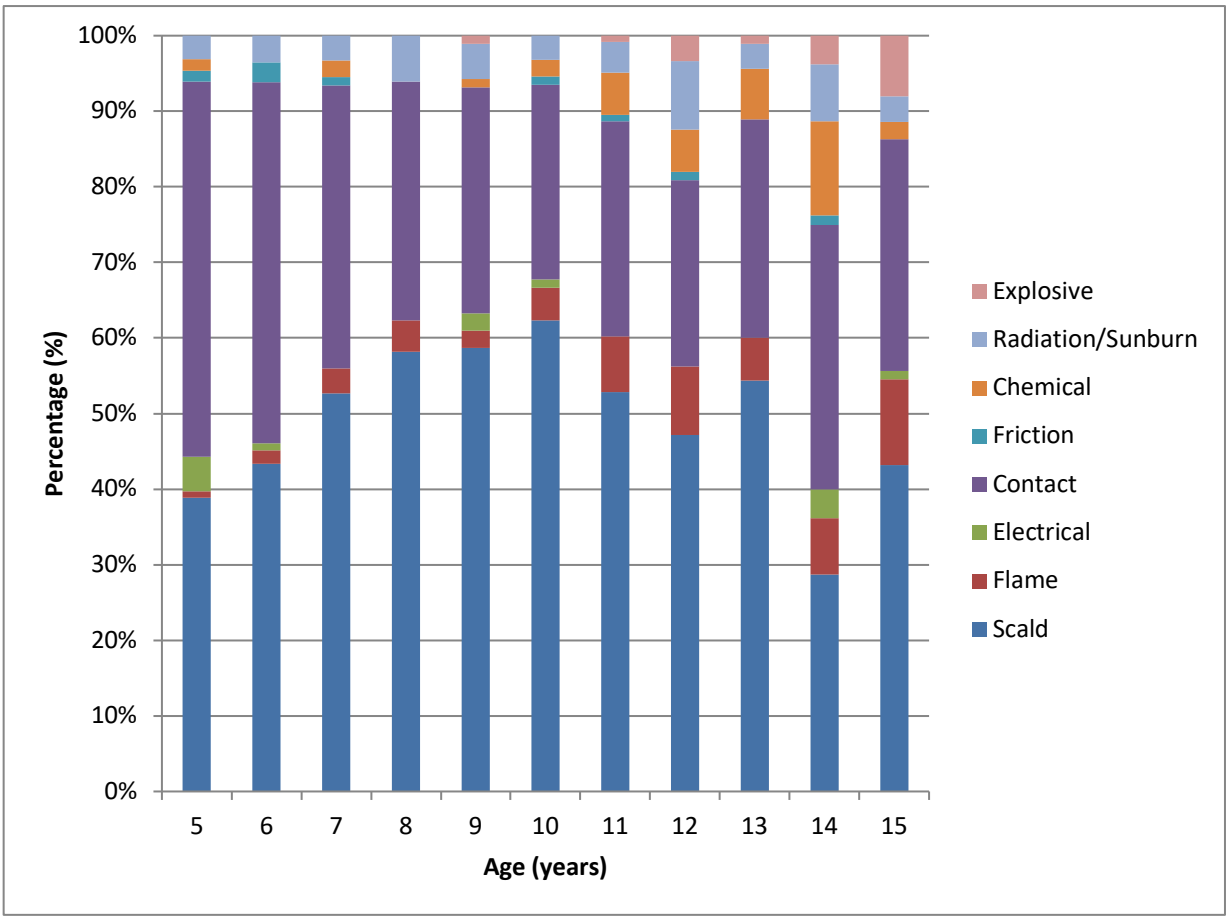


Figure 5 - Percentage of Injury Type of burns from the Children's Burns Research Database for 2013 – 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham] by year of age (n = 1,084)

The proportion of scalds increased from 5 to 10 years, and decreased thereafter (Appendix 20). The highest percentage of contact burns by age occurred in the five-year-olds, at 49.6% of all injuries to 5-year-olds (95% CI 41.2% to 58.1%); followed by six and seven-year-olds at 47.8% (95% CI 38.8% to 56.9%) and 37.4% (95% CI 28.1% to 47.6%) respectively. Flame burns were the third highest injury type at 5.0% across all ages, with highest incidence for those aged 15 at 11.4% (95% CI 6.3% to 19.7%) of burn types for this age, followed by 11-year-olds at 7.3% (95% CI 3.9% to 13.2%).

2.5.3 Agent

Percentage of burns by agent and age are described in Figure 6. The most common agent was hot water at 23.5% of all burns; followed by hot drinks 16.0%, hot food 11.6%, cooking appliances/oven 9.9%, hair styling devices 5.5%, sun 4.5%, outdoor heat/fire source 3.6%, aerosol 3.4%, an iron 2.7%, vehicle exhausts 2.7%, fireworks 2.6%, radiator 1.5% and petrol 0.8% (Appendix 21). 'Other' were the fourth largest group at 11.5% of all injuries and 0.5% of agents were missing.

When analysed by age-group those aged 8 -10 years, 11 – 13 years and 14 – 15 years there was a significant association between burn agent and age-group when compared to those aged 5 – 7 years.

A weak association was observed between those aged 8 – 10 years (X^2 (6) = 23.901, *p* =.001, Cramer's V = .197), and those aged 14 – 15 years (X^2 (6) = 18.924, *p* = .004, Cramer's V = .194) (Rea and Parker, 1992). A moderate association was observed between those aged 11 – 13 years (X^2 (6) = 28.560, *p* = <.001, Cramer's V = .194) and those aged 5 – 7 years (Rea and Parker, 1992). Results suggest that scald injuries were more likely to occur to those aged 8 – 10 years, compared to those aged 5 – 7, and flame and explosive burns more likely to occur to those aged 14 – 15, and flame burns to those aged 11 – 13 and 14 – 15 that's 5 – 7 years.

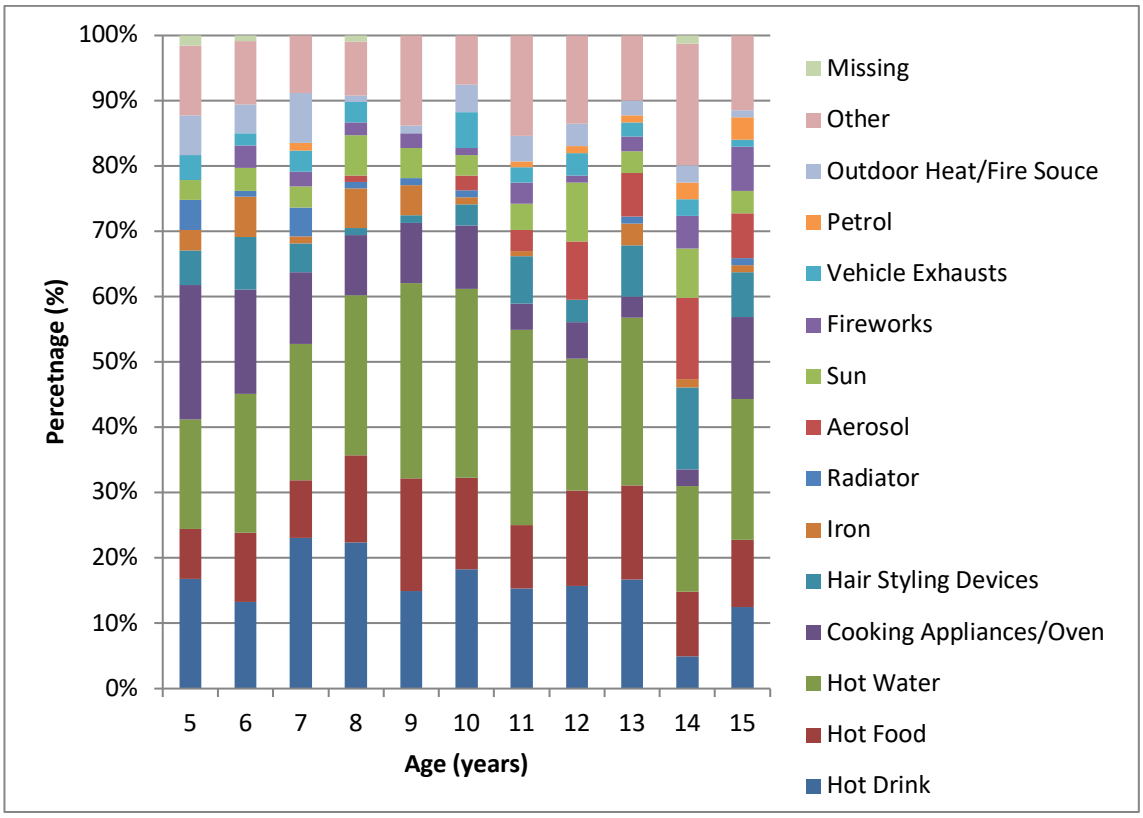


Figure 6 – Percentage of agent of burns from the Children's Burns Research Database for 2013 – 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham] by year of age (n = 1,084)

The highest percentage of injuries caused by hot water, around a third, occurred to the nine-year-olds at 29.9% (95% CI 20.8% to 38.9%) 11-year-olds (29.8%, 95% CI 22.5% to 38.4%) and ten-year-olds (29.0%, 95% CI 20.8% to 38.9%) respectively (Appendix 21). The highest percentage of hot drink burns occurred to seven-year-olds at 23.1% (95% CI 15.6% to 32.7%), followed by eight-year-olds 22.4% (95% CI 15.3% to 31.7%) and five-year-olds 16.8% (95% CI 11.4% to 24.1%) respectively. The highest percentage of hot food burns occurred to the nine-year olds at 17.2% (95% CI 10.7% to 26.5%), followed by twelve-year-olds 14.6% (95% CI 8.7% to 23.4%) and thirteen-year-olds 14.4% (95% CI 8.6% to 23.2%). Peak ages for other burn agents were five-years for cooking appliances/oven (20.6%, 95% CI 14.6% to 28).

2.5.4 Mechanism

Mechanism by age is displayed in Figure 7. The most frequent mechanism of injury was spill at 30.5% (331/1084) of all injuries, followed by touch 29.7% (322), splash 9.0% (98), fell/ran into 5.4% (58), explosion 4.6% (50), exposure to sun 4.5% (49), pull down 3.9% (42), spray 1.7% (18) and immersion 0.6% (6) respectively (Appendix 22). 'Other' were the fourth largest group at 7.8% (85) of all injuries, the mechanism was not known in 1.6% (18) of the sample and missing for 0.6% (7).

When analysed by age-group those aged 8 - 10 years, 11 – 13 years and 14 – 15 years there was a significant difference between burn mechanism and age-group when compared to those aged 5 – 7 years. A weak association was observed between those aged 8 – 10 years (X^2 (6) = 22.475, *p* =.001, Cramer's V = .191), and moderate associations between those aged 11- 13 years (X^2 (6) = 39.286, *p* <.001, Cramer's V = .248), and those aged 14 – 15 years (X^2 (6) = 45.306, *p* <.001, Cramer's V = .300), when compared to those aged 5 – 7 years (Rea and Parker, 1992). Results suggest that burns injury mechanisms to those aged 5 – 7 years are more likely to be from cooking appliance/oven, irons and outdoor heat sources when compared to other age-groups.

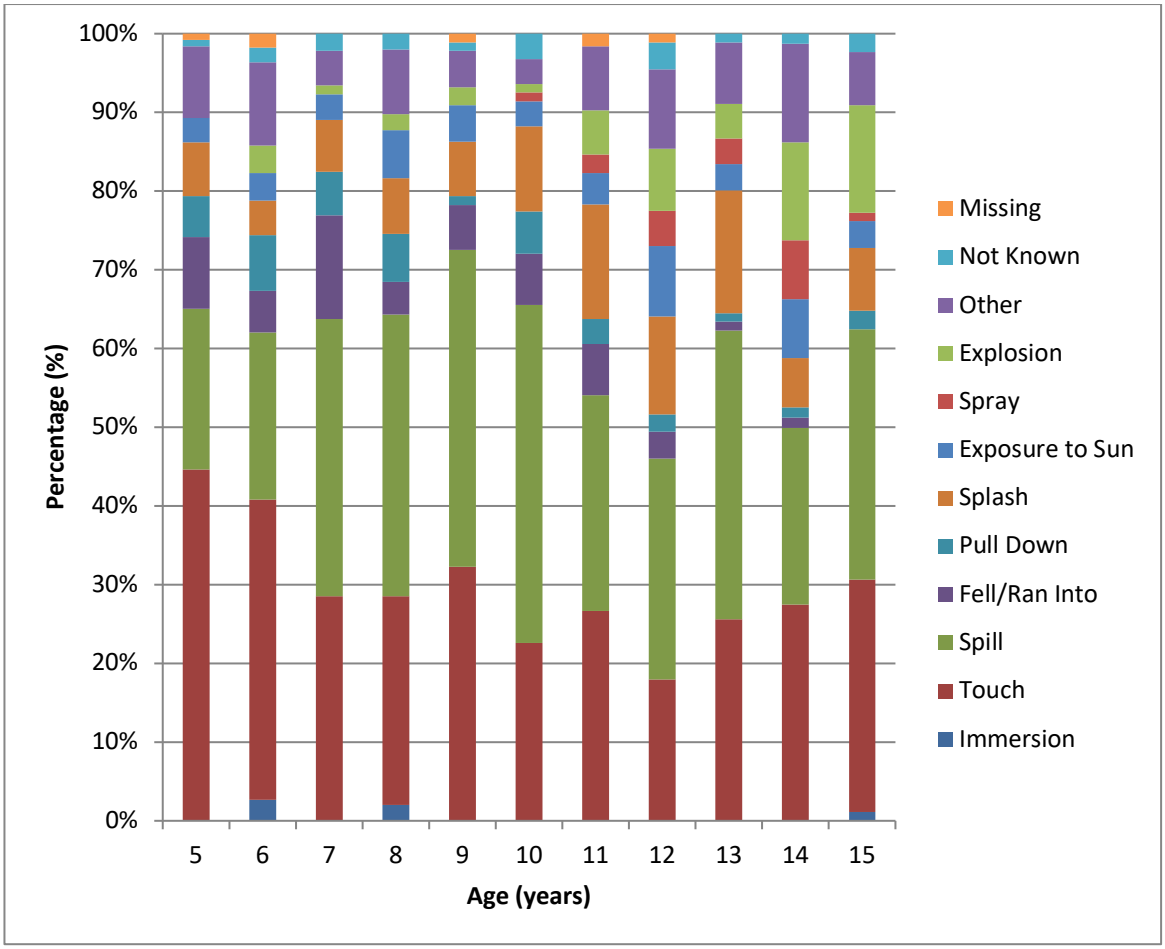


Figure 7 – Percentage of mechanism of injury from the Children's Burns Research Database for 2013 – 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham] by year of age (n = 1,084)

The highest percentage of injuries caused by spills occurred to the 10-year-olds at 43.0% (40/93, 95% CI 33.4% to 53.2%) of all burns at this age, followed by nine-year-olds 40.2% (95% CI 30.6% to 50.7%) and eight-year-olds 35.7% (95% CI 26.9% to 45.6%) respectively [Appendix 30]. The highest percentage of burns from 'touch' occurred to five-year-olds at 45.0% (58/131, 95% CI 36.1% to 52.8%) of all burns for this age, followed by six-year-olds 38.1% (43/113, 95% CI 29.6% to 47.3%) and 15-year-olds 29.5% (26/88, 95% CI 21.0% to 39.8%) respectively.

2.5.5 Scalds

Scalds accounted for 49.1% of injuries. Four categories of agent were involved; hot water 46.6%, hot drinks 32.5%, hot food 19.4% and other 1.5% (Table 9). The majority of scald burns occurred to females at 60.3%.

For those aged 5 – 7 years scalds caused by the spilling of hot drinks were most common at 25.7% of all scald injuries in this age group, followed by spilling hot water at 18.2% (Table 6). This is reversed for those aged 8 – 10, 11 – 13 and 14 – 15 with scalds caused by spilling hot water the most frequent, followed by spilling hot drinks. An expanded table of scald injuries by all mechanisms of action by age group and agent can be found in Appendix 22.

Table 6 - Number, percentage and 95% confidence interval of scald agent and mechanism by age group (n = 532) from the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

	Hot Water (248)	Hot Drinks (173)	Hot Food (103)	Other (5)	Fireworks (1)	Radiator (1)	Cooking Appliance/Oven (1)
Mechanisms in those aged 5 – 7 years Total number of children (148)							
Spill	27 18.2% (12.9% to 25.2%)	38 25.7% (19.3% to 33.3%)	15 10.1% (6.2% to 16.1%)	-	-	-	-
Splash	12 8.1% (4.7% to 13.6%)	4 2.7% (1.1% to 6.7%)	4 2.7% (1.1% to 6.7%)	-	-	-	-
Pull down	9 6.1% (3.2% to 11.2%)	7 4.7%	4 2.7% (1.1% to 6.7%)	-	-	-	-
Fell/Ran into	5 3.4% (1.5% to 7.8%)	4 2.7% (1.1% to 6.7%)	2 1.4% (0.4% to 4.8%)	-	-	-	-
Immersion	3 2.0% (0.7% to 5.8%)	-	-	-	-	-	-
Touch	-	-	-	1 0.0% (0.0% to 0.0%)	-	-	-
Explosion	2 0.0%	-	-	-	-	-	-

	(0.0% to 0.0%)						
Other	6 4.1% (1.9% to 8.6%)	2 1.4% (0.4% to 4.8%)	-	-	-	-	-
Not Known	-	1 0.7% (0.1% to 3.7%)	-	-	-	-	-
Missing	-	2 1.4% (0.4% to 4.8%)	-	-	-	-	-
Mechanisms in those aged 8 – 10 years Total number of children (166)							
Spill	46 27.7% (21.5% to 35.0%)	40 24.1% (18.2% to 31.3%)	19 11.4% (.5% to 17.2%)	1 0.6% (0.1% to 3.3%)	-	-	-
Splash	14 8.4% (5.1% to 13.7%)	2 1.2% (0.3% to 4.3%)	6 3.6% (1.7% to 7.7%)	1 0.6% (0.1% to 3.3%)	-	-	-
Immersion	-	-	2 1.2% (0.3% to 4.3%)	-	-	-	-
Touch	4 2.4% (0.9% to 6.0%)	1 0.6% (0.1% to 3.3%)	1 0.6% (0.1% to 3.3%)	-	1 0.6% (0.1% to 3.3%)	-	-
Fell/Ran into	4 2.4% (0.9% to 6.0%)	3 1.8% (0.6% to 5.2%)	2 1.2% (0.3% to 4.3%)	-	-	-	-
Pull down	4 2.4%	3 1.8%	2 1.2%	-	-	-	-

	(0.9% to 6.0%)	(0.6% to 5.2%)	(0.3% to 4.3%)				
Other	4 2.4% (0.9% to 6.0%)	1 0.6% (0.1% to 3.3%)	2 1.2% (0.3% to 4.3%)	-	-	-	-
Not known	-	2 1.2% (0.3% to 4.3%)	-	-	-	1 0.6% (0.1% to 3.3%)	-
Mechanisms in those aged 11 – 13 years Total number of children (157)							
Spill	40 25.5% (19.3% to 32.8%)	31 19.7% (14.3% to 26.7%)	17 10.8% (CI 6.9% to 16.7%)	-	-	-	-
Splash	21 13.4% (8.9% to 19.6%)	10 6.4% (3.5% to 11.3%)	10 6.4% (3.5% to 11.3%)	-	-	-	-
Pull down	2 1.3% (0.4% to 4.5%)	4 2.6% (1.0% to 6.4%)	1 0.6% (0.1% to 3.5%)	-	-	-	-
Fell/Ran into	2 1.3% (0.4% to 4.5%)	1 0.6% (0.1% to 3.5%)	-	-	-	-	-
Touch	2 1.3% (0.4% to 4.5%)	1 0.6% (0.1% to 3.5%)	1 0.6% (0.1% to 3.5%)	1 0.6% (0.1% to 3.5%)	-	-	-
Spray	1 0.6% (0.1% to 3.5%)	-	-	-	-	-	-
Other	6 3.8%	-	1 0.6%	-	-	-	-

	1.8% to 8.1%)		(0.1% to 3.5%)				
Not known	1 0.6% (0.1% to 3.5%)	1 0.6% (0.1% to 3.5%)	-	-	-	-	-
Missing	2 1.3% (0.4% to 4.5%)	-	1 0.6% (0.1% to 3.5%)	-	-	-	-
Mechanisms in those aged 14 – 15 years Total number of children (61)							
Spill	19 31.2% (20.9% to 43.2%)	11 18.0% (10.4% to 29.5%)	10 16.4% (9.2% to 27.6%)	-	-	-	-
Splash	5 8.2% (3.6% to 17.8%)	2 3.3% (0.9% to 11.2%)	3 4.9% (1.7% to 13.5%)	1 1.6% (0.3% to 8.7%)	-	-	-
Immersion	1 1.6% (0.3% to 8.7%)	-	-	-	-	-	-
Touch	1 1.6% (0.3% to 8.7%)	-	-	-	-	-	1 1.6% (0.3% to 8.7%)
Pull down	2 3.3% (0.9% to 11.2%)	-	-	-	-	-	-
Other	3 4.9% (1.7% to 13.5%)	-	-	-	-	-	-
Not known	-	2 3.3%	-	-	-	-	-

(0.9% to 11.2%)

2.5.6 Contact Burns

Contact burns accounted for 34.3% of burns. They were the second highest form of injury. Six main categories of agent were involved; cooking appliances/oven 28.2%, hair styling devices 15.9%, outdoor heat/fire source 7.3%, iron 7.8%, radiator 4.0%, vehicle exhausts 7.5% and other (combination of other agents and 'other' category due to size) 35.5% (Table 7). The majority of contact burns occurred to males at 51.9%.

For those aged 5 – 7 and 8 – 10 years contact burns caused by touching cooking appliances/oven were the most common (Table 7). Following this, for those aged 5 - 7 years burns caused by touching hair styling devices were the second most frequent and touching vehicle exhausts for those aged 8 – 10 years. For the age group 11 – 13 years the most common contact burn injury was caused by touching a hairstyling device of contact burns in this group, followed by touching a cooking appliance/oven. For those aged 14 – 15 years the most frequent injury was caused by touching a hair styling device at or touching cooking appliance/oven at. An expanded table of contact injuries by all mechanisms of action, by age group and agent can be found in Appendix 24.

Table 7 - Number, percentage and 95% confidence interval of contact burn agent and mechanism by age group (n = 372) from the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

	Cooking Appliances/Oven (105)	Hair Styling Devices (59)	Outdoor Heat/Fire Source (27)	Iron (29)	Radiator (15)	Vehicle Exhausts (28)	Other (62)	Hot water (4)	Hot food (24)	Fireworks (15)	Aerosol (1)	Missing (5)
Mechanisms in those aged 5 – 7 years Total number of children (153)												
Touch	50 32.7% (25.8% to 40.5%)	16 10.5% (6.5% to 16.3%)	12 7.8% (4.5% to 13.2%)	8 5.2% (2.7% to 10.0%)	10 6.5% (3.6% to 11.6%)	7 4.6% (2.2% to 9.2%)	10 6.5% (3.6% to 11.6%)	1 0.7% (0.1% to 4.1%)	3 2.0% (0.7% to 5.6%)	1 0.7% (0.1% to 4.1%)	-	2 1.3% (0.4% to 4.6%)
Fell/Ran into	4 2.6% (.0% to 6.5%)	2 1.3% (0.4% to 4.6%)	4 2.6% (1.0% to 6.5%)	1 0.7% (0.1% to 4.1%)	1 0.7% (0.1% to 4.1%)	1 0.7% (0.1% to 4.1%)	2 1.3% (0.4% to 4.6%)	-	-	-	-	-
Other	-	2 1.3% (0.4% to 4.6%)	1 0.7% (0.1% to 4.1%)	3 2.0% (0.7% to 5.6%)	-	-	2 1.3% (0.4% to 4.6%)	-	-	2 1.3% (0.4% to 4.6%)	-	-
Spill	-	-	-	-	-	-	-	-	2 1.3% (0.4% to 4.6%)	-	-	-
Explosion	-	-	1	-	-	-	-	-	-	2	-	-

			0.7% (0.1% to 4.1%)							1.3% (0.4% to 4.6%)		
Not known	-	-	-	-	-	1 0.7% (0.1% to 4.1%)	1 0.7% (0.1% to 4.1%)	-	-	-	-	-
Missing	-	-	-	-	-	-	-	-	-	-	-	1 0.7% (0.1% to 4.1%)
Mechanisms in those aged 8 – 10 years Total number of children (81)												
Touch	25 30.9% (21.9% to 41.6%)	4 4.9% (1.9% to 12.0%)	2 2.3% (0.7% to 8.6%)	5 6.2% (2.7% to 13.7%)	1 1.2% (0.1% to 6.7%)	6 7.4% (3.4% to 15.2%)	14 17.3% (10.6% to 26.9%)	1 1.2% (0.1% to 6.7%)	5 (6.2% (2.7% to 13.7%)	-	-	1 1.2% (0.1% to 6.7%)
Fell/Ran into	1 1.2% (0.1% to 6.7%)	-	1 1.2% (0.1% to 6.7%)	2 2.3% (0.7% to 8.6%)	1 1.2% (0.1% to 6.7%)	-	-	-	-	-	-	-
Spill	-	-	-	-	-	-	1 1.2% (0.1% to 6.7%)		2 2.3% (0.7% to 8.6%)	-	-	-
Explosion	-	-	-	-	-	-	-	-	-	3	-	-

										3.7% (1.3% to 10.3%)		
Pull down	-	-	-	2 2.3% (0.7% to 8.6%)	-	-	-	-	-	-	-	-
Not known	-	-	-	1 1.2% (0.1% to 6.7%)	-	2 2.3% (0.7% to 8.6%)	-	-	-	-	-	-
Missing	-	-	-	1 1.2% (0.1% to 6.7%)	-	-	-	-	-	-	-	-
Mechanisms in those aged 11 – 13 years Total number of children (83)												
Touch	12 14.5% (8.5% to 23.6%)	15 18.1% (11.3% to 27.7%)	3 3.6% (1.2% to 10.1%)	3 3.6% (1.2% to 10.1%)	1 1.2% (0.2% to 6.5%)	7 8.4% (4.1% to 16.4%)	13 15.7% (9.4% to 25.0%)	1 1.2% (0.2% to 6.5%)	4 4.8% (1.9% to 11.8%)	1 1.2% (0.2% to 6.5%)	-	-
Fell/Ran into	-	1 1.2% (0.2% to 6.5%)	1 1.2% (0.2% to 6.5%)	1 1.2%	-	1 1.2% (0.2% to 6.5%)	1 1.2% (0.2% to 6.5%)	-	-	-	-	-

				(0.2% to 6.5%)								
Other	1 1.2% (0.2% to 6.5%)	3 3.6% (1.2% to 10.1%)	-	-	-	-	6 7.2% (3.4% to 14.9%)	-	1 1.2% (0.2% to 6.5%)	-	-	-
Spill	-	-	-	-	-	-	-	-	2 2.4% (0.6% to 8.4%)	-	-	-
Splash	-	-	-	-	-	-	1 1.2% (0.2% to 6.5%)	-	-	-	-	-
Spray	-	-	-	-	-	-	-	-	-	-	1 1.2% (0.2% to 6.5%)	-
Explosion	-	-	-	-	-	-	1 1.2% (0.2% to 6.5%)	-	-	2 2.4% (0.6% to 8.4%)	-	-
Mechanisms in those aged 14 – 15 years Total number of children (55)												
Touch	12 21.8% (13.0% to 34.4%)	13 23.6%	2 3.6%	1 1.8%	1 1.8%	2 3.6%	5 9.1%	1 1.8%	1 1.8%	2 3.6%	-	1 1.8%

		(14.4% to 36.4%)	(1.0% to 12.3%)	(0.3% to 9.6%)	(0.3% to 9.6%)	(1.0% to 12.3%)	(4.0% to 19.6%)	(0.3% to 9.6%)	(0.3% to 9.6%)	(1.0% to 12.3%)		(0.3% to 9.6%)
Fell/Ran into	-	1 1.8% (0.3% to 9.6%)	-	-	-	-	-	-	-	-	-	-
Other	-	2 3.6% (1.0% to 12.3%)	-	-	-	1 1.8% (0.3% to 9.6%)	1 1.8% (0.3% to 9.6%)	-	-	-	-	-
Spill	-	-	-	-	-	-	1 1.8% (0.3% to 9.6%)	-	2 3.6% (1.0% to 12.3%)	-	-	-
Pull down	-	-	-	1 1.8% (0.3% to 9.6%)	-	-	-	-	-	-	-	-
Explosion	-	-	-	-	-	-	2 3.6% (1.0% to 12.3%)	-	1 1.8% (0.3% to 9.6%)	2 3.6% (1.0% to 12.3%)	-	-

2.5.7 Preparation, Consumption and the Moving/Carrying of Hot Food/Drink

Of all injuries 46.4% were directly related to the making, consumption or moving/carrying of hot food or drink (Table 8). Making hot food or drink was the most frequent action being undertaken whilst the burn occurred for all injuries, followed by moving/carrying hot food or drink or consuming hot food or drink across the entire dataset. By age group making hot food or drink was the most common action across all age groups. Moving/carrying hot food or drink was the second most frequent action for those aged 5 – 7 and 8 – 10 years and for all injuries in these groups respectively. Consuming hot food or drink was the second highest action for those aged 11 – 13 and 14 – 15 years respectively.

Table 8 - Number, percentage and 95% confidence interval of burn injuries related to the preparation, consumption or moving/carrying of hot food or drink by age group (n = 1,084) in the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

Action	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
Making hot food or drink	88 (26.3%) (21.9% to 31.2%)	77 (27.7%) (22.8% to 33.2%)	76 (25.1%) (20.5% to 30.3%)	42 (25.0%) (19.1% to 32.1%)	**283 (26.1%) (23.6% to 28.8%)**
Consuming hot food or drink	32 (9.6%) (6.9% to 13.2%)	32 (11.5%) (8.3% to 15.8%)	26 (8.6%) (5.9% to 12.3%)	10 (6.0%) (3.3% to 10.6%)	**100 (9.2%) (7.7% to 11.1%)**
Moving/carrying hot food or drink	50 (14.9%) (CI 11.5% to 19.1%)	47 (16.9%) (13.0% to 21.8%)	21 (6.9%) (4.6% to 10.4%)	2 (1.2%) (0.3% to 4.2%)	**120 (11.1%) (9.3% to 13.1%)**
Not enough information provided	17 (5.1%) (3.2% to 8.0%)	16 (5.8%) (3.6% to 9.2%)	20 (6.6%) (4.3% to 10.0%)	19 (11.3%) (7.4% to 17.0%)	**72 (6.6%) (5.3% to 8.3%)**
N/A	148 (44.2%) (39.0% to 49.5%)	106 (38.1%) (32.6% to 44.05)	160 (52.8%) (47.2% to 58.4%)	95 (56.5%) (49.0% to 63.8%)	**509 (47.0%) (44.0% to 49.9%)**
Total	**335**	**278**	**303**	**168**	**1084**

2.5.8 When and Where the Injuries Occurred

2.5.8.1 Injury Location

Injury location data is presented by age group in Table 9. The most frequent injury location was the home across all age groups but the proportion decreases with age as older children experience burns in different locations. When compared to the 5 – 7 years age-group analyses suggest that moderate statistically significant associations exist between injury location and age-group for those aged 11 – 13 years (X^2 (5) = 30.779, p <.001, Cramer's V = .220) and those aged 14 – 15 years (X^2 (5) = 37.715, p <.001, Cramer's V = .274) (Rea and Parker, 1992). No statistical difference was found between those aged 5 – 7 years and 8 –

11 years (*p* =1.40) (Appendix 19). Results suggest that those in the older age groups are more likely to sustain injuries outside of the home environment.

Table 9 - Number, percentage and 95% confidence interval of injury location by age group (n = 1,084 in the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

Injury Location	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
Home	257 (76.7%) (71.9% to 80.9%)	205 (73.7%) (68.3% to 78.6%)	191 (63.0%) (57.5% to 68.3%)	93 (55.4%) (47.8% to 62.7%)	**746 (68.8%) (66.0% to 71.5%)**
Family/Friend's House	24 (7.2%) (4.9% to 10.4%)	12 (4.3%) (2.5% to 7.4%)	28 (9.2%) (6.5% to 13.0%)	10 (6.0%) (3.3% to 10.6%)	**64 (5.9%) (4.7% to 7.5%)**
School	6 (1.8%) (0.8% to 3.9%)	9 (3.2%) (1.7% to 6.0%)	29 (9.6%) (6.8% to 13.4%)	13 (7.7%) (4.6% to 12.8%)	**57 (5.3%) (4.1% to 6.8%)**
Café/Restaurant	4 (1.2%) (0.5% to 3.0%)	3 (1.1%) (0.4% to 3.1%)	6 (2.0%) (0.9% to 4.3%)	6 (3.6%) (1.7% to 7.6%)	**19 (1.8%) (1.1% to 2.7%)**
Other	34 (10.1%) (7.4% to 13.9%)	44 (15.8%) (12.0% to 20.6%)	54 (17.8%) (13.9% to 22.5%)	42 (25.0%) (19.1% to 32.1%)	**174 (16.1%) (14.0% to 18.4%)**
Missing	10 (3.0%) (1.6% to 5.4%)	5 (1.8%) (0.8% to 4.1%)	5 (1.7%) (0.7% to 3.8%)	4 (2.4%) (0.9% to 6.0%)	**24 (2.2%) (1.5% to 3.3%)**
Total	**335**	**278**	**303**	**168**	**1084**

2.5.8.2 Time of the day

Figures 8 and 9 show the number of injuries by the hour of the day in which they occurred, and a breakdown of this by age group. When analysed by age group only those aged 14 – 15 years had a weak statistically significant association with time of the day and age-group compared to those aged 5 – 7 years (X^2 (5) = 12.647, *p* =.027, Cramer's V = .171) (Rea and

Parker, 1992) suggesting a higher incidence of burn injuries to older children at nighttime. Results were statistically insignificant for those aged 8 – 10 years (*p* =.354) and 11 – 13 years (*p* =.611) (Appendix 28).

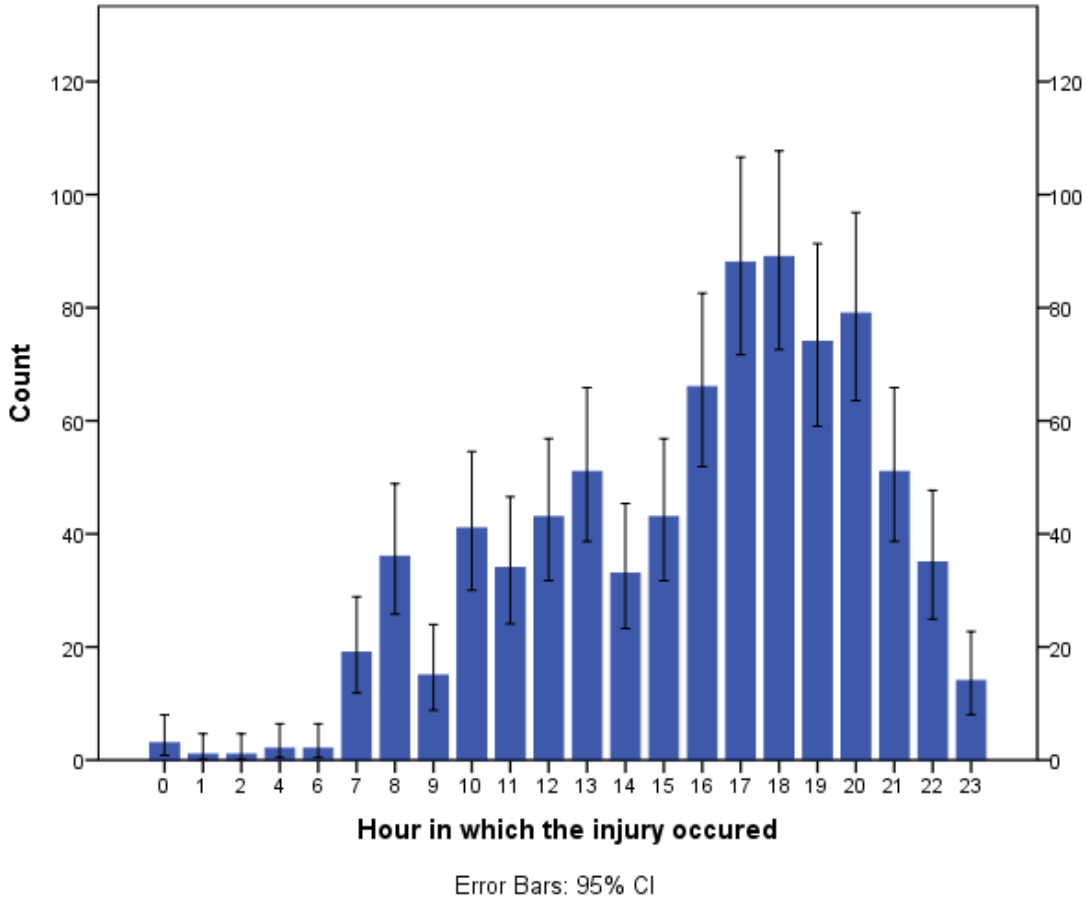


Figure 8 - Count (95% Confidence Interval) of the hour of injury occurrence for all ages (n = 1,084) from the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

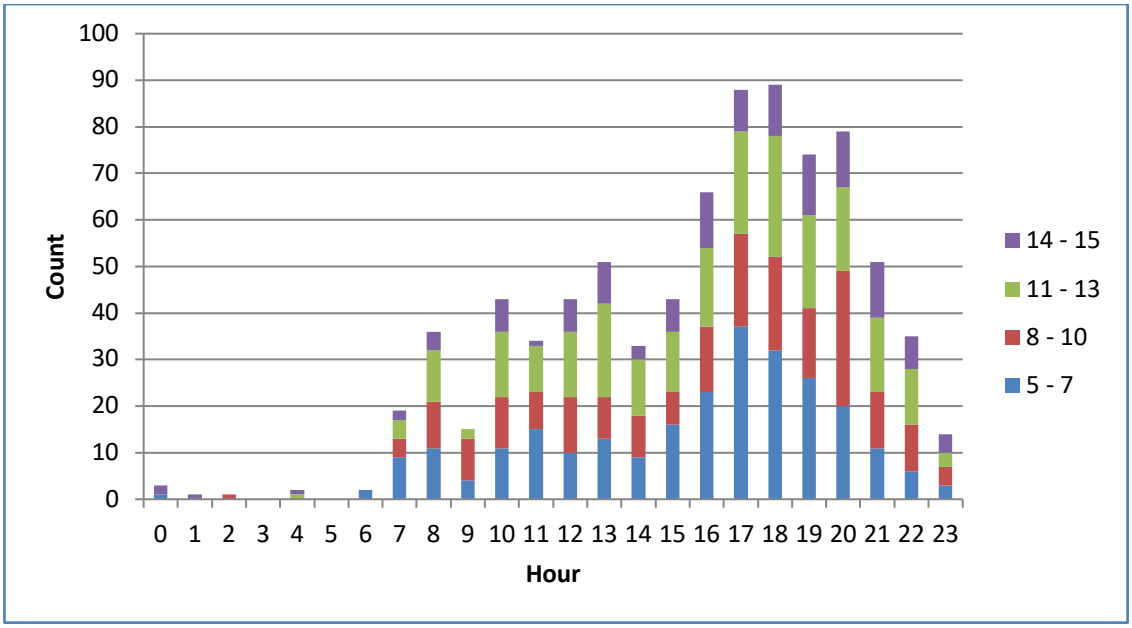


Figure 9 - Count of the hour of injury occurrence by age group (n = 1,084) from the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

3.5.8.3 Day of the Week & Weekday vs Weekend

Data show little difference in the number of instances by day. Saturday had the highest incidence at 18.5% for all ages. Over one third of all injuries occurred at the weekend at 35.8% (Table 10).

Chi-square analysis suggest that there is a weak statistically significant association for injuries occurring at the weekend; in comparison to 5-7 year olds, those aged 8 – 10 years (X^2 (7) = 5.533, *p* =.038, Cramer's V = .156) and 11 – 13 years (X^2 (6) = 14.665, *p* =.023, Cramer's V = .152) had a greater proportion of injuries at the weekend . Results show a non-significant association for those aged 14 – 15 years (*p* =.284) (Appendix 19). When analysed by weekday vs weekend with a Fisher Exact test no significant associations were found for any age groups when compared to those aged 5 – 7 years (8 – 10 years, *p* = .142; 11 – 13 years, *p* =.145; 14 – 15 years, *p* =.234) (Appendix 19).

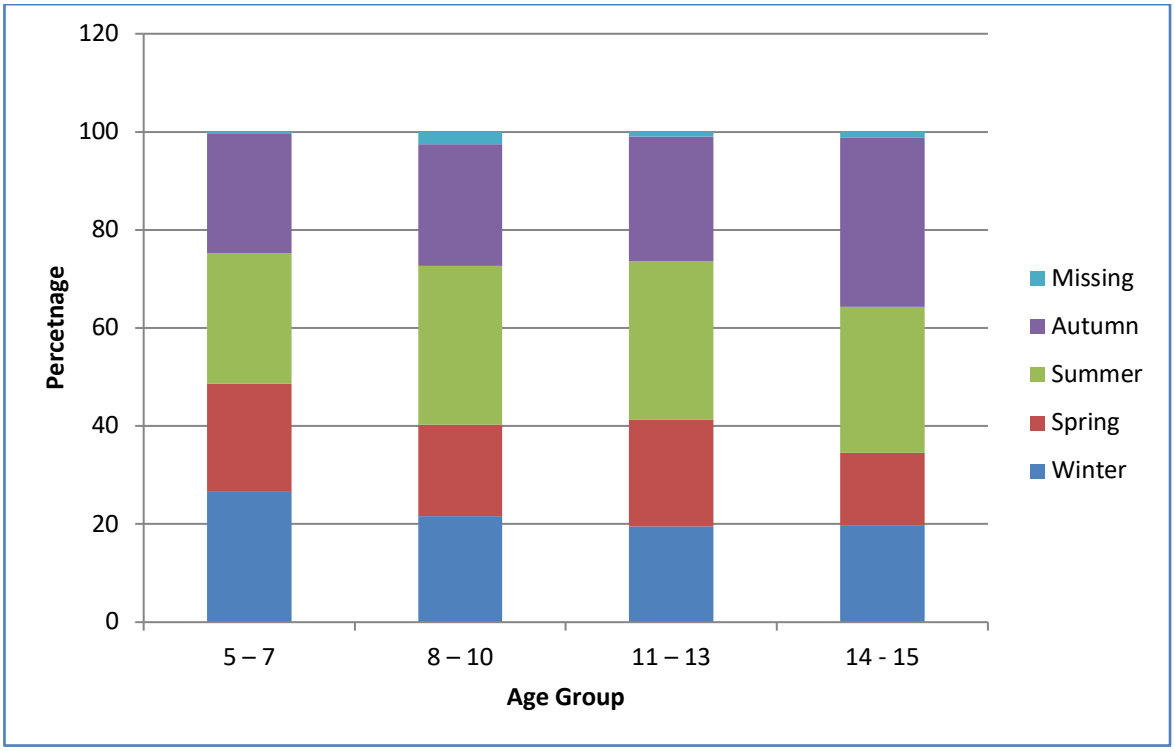
Table 10 - Number and percentage of injuries occurring by day of the week by age group, and number, percentage and 95% confidence interval of injuries occurring in the week and at the weekend (n = 1,084) in the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

Age (years)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Missing	Total
5 – 7	40 (11.9%)	43 (12.8%)	26 (7.8%)	47 (14.0%)	41 (12.2%)	74 (22.1%)	62 (18.5%)	2 (0.6%)	335
8 – 10	30 (10.8%)	42 (15.1%)	43 (15.5%)	31 (11.2%)	29 (10.4%)	45 (16.2%)	51 (18.2%)	7 (2.5%)	278
11 – 13	42 (13.9%)	27 (8.9%)	44 (14.5%)	37 (12.2%)	50 (16.5%)	50 (16.5%)	50 (16.5%)	3 (1.0%)	303
14 - 15	24 (14.3%)	21 (12.5%)	21 (12.5%)	17 (10.1%)	27 (16.1%)	32 (19.0%)	24 (14.3%)	2 (1.2%)	168
Total	136 (12.5%)	133 (12.3%)	134 (12.4%)	132 (12.2%)	147 (13.6%)	201 (18.5%)	187 (17.3%)	14 (1.3%)	1084
	Weekday					**Weekend**			
5 – 7	197 (58.8%) (95% CI 53.5% to 64.0%)					136 (40.6%) (95% CI 35.5% to 45.9%)		2 (0.6%)	335
8 – 10	175 (62.9%) (95% CI 57.1% to 68.4%)					96 (34.5%) (95% CI 29.2% to 40.3%)		7 (2.5%)	278
11 – 13	200 (66.0%) (95% CI 60.5% to 71.1%)					100 (33.0%) (95% CI 28.0% to 38.5%)		3 (1.0%)	303
14 - 15	110 (65.5%) (95% CI 58.0% to 72.3%)					56 (33.3%) (95% CI 26.6% to 40.8%)		2 (1.2%)	168
Total	682 (62.9%) (95% CI 60.0% to 65.8%)					388 (35.8%) (95% CI 33.0% to 38.7%)		14 (1.3%)	1084

2.5.8.4 Season

Summer was the most common season for burns across all ages (Appendix 26). Chi-square analysis showed no statistical differences between season when the injury occurred and those aged 5 - 7 and 8 – 10 years, and those aged 5 - 7 and 11 – 13 years, though a weak statistical association was shown between those 5 - 7 and 14 - 15 years (X^2 (3) = 9.928, *p*

=.019, Cramer's V = .141) (Rea and Parker, 1993). The most common season for burn injuries for those aged 5 – 7 were winter and summer equally at 26.6% (95% CI 22.1% to 31.6%), summer for both 8 – 10 years at 32.4% (95% CI27.1% to 38.1%) and 11 – 13 years at 32.3% (95% CI 27.3% to 37.8%) and autumn for those aged 14 – 15 at 34.5% of injuries (95% CI 27.8% to 42.0%) (Figure 11 & Appendix 26).



Winter = December, January and February. Spring = March, April and May. Summer = June, July and August. Autumn = September, October and November.

Figure 10 - Count of the season of injury occurrence by age group (n = 1,084) from the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

2.5.9 First-Aid

All first-aid data are presented in Appendix 27, levels of appropriate first-aid are reported in Table 11. Some attempt at first-aid was provided in 78.8% of cases. Optimum first-aid

delivery, assessed in-line with the British Burns Associations Position statement (2014) (cool running water for 20 minutes (or more when appropriate) and covering with a sterile non-fluffy dressing), occurred in 14 cases across all ages, 1.3% of the entire sample.

2.5.9.1 Cooling

Cold water was provided in 51.2% of all injuries, 65.0% where some form of first-aid was provided. Cold water was applied to the injury in the form of running water in 50.0% followed by immersion in 37.7% cases. The most frequent duration for cold water application was ≥ 20 minutes for 28.8%. By age group the application of cold water was most frequently applied to those aged 5 – 7 years, and this group also had the most frequent application of running water at 52.0%of cold water application (Appendix 27).

2.5.9.2 Covering

The injury was covered in 40.2% of all injuries, 51.1% of those who received any form of first-aid. Those aged 5 – 7 years received the most injury coverings at 46.9% of all injuries in this group; the lowest was those aged 14 – 15 years at 31.5%. Clingfilm was the most common material used to cover the injury in 38.8% of all covered injuries, followed by a t-towel/flannel 17.4%, bandage 7.6%, wet compress 6.0%, cold compress 4.6%, Jelonet/burn dressing 4.4% and a plaster 2.3% (Appendix 27).

2.5.9.3 Other Treatments

'Other' treatments (pertaining to those first-aid actions excluding the use of water to cool the injury) were applied to 27.6% of all injuries, 35.0% of all injuries where some form of first-aid was applied. The most common alternative treatment was the use of a cream/gel/ointment at 30.8% of all other treatments (Appendix 27).

2.5.9.4 First-aid by severity of injury

Data on first-aid applied and depth of injury were available for 858 cases, 79.2% of the overall sample. Where data were available results show that first aid was provided most

frequently for those with injury depth 3 burns (partial thickness, broken skin, wet/pink) (95.5%).

Table 11 - Number and percentage of whether first-aid was administered, and whether administrated was in-line with each step of the British Burns Association (2014) guidelines by age group (n = 1,084) in the Children's Burns Research Database 2013 - 2017 for presentations to included burns units, emergency departments and minor injury units [Cardiff, Bristol, North Manchester, Wrexham, Swansea and Birmingham]

	Age Groups (years)				Total
	5-7 (n = 335)	8 – 10 (n = 278)	11 – 13 (n = 303)	14 – 15 (n = 168)	n = 1084
Was first aid given?					
Yes	268 (80.8%)	218 (78.4%)	245 (80.9%)	123 (73.2%)	854 (78.8%)
No	16 (4.8%)	24 (8.6%)	12 (4.0%)	11 (6.5%)	63 (5.8%)
Missing	51 (15.2%)	36 (12.9%)	46 (15.2%)	34 (20.2%)	167 (15.4%)
Of those that cooled the injury, was the cooling method appropriate according to BBA guidelines-					
Appropriate	93 (27.8%)	61 (21.9%)	81 (26.7%)	42 (25.0%)	277 (25.6%)
Inappropriate	89 (26.6%)	81 (29.1%)	85 (28.1%)	44 (26.2%)	299 (27.6%)
Of those that cooled the injury, was the cooling duration appropriate according to BBA guidelines -					
Appropriate	47 (14.0%)	36 (12.9%)	51 (16.8%)	26 (15.5%)	160 (14.8%)
Inappropriate	89 (26.6%)	73 (26.3%)	82 (27.1%)	40 (23.8%)	284 (26.2%)
Of those that were covered, was the cover appropriate according to BBA guidelines -					
Appropriate	65 (19.4%)	48 (17.3%)	54 (17.8%)	21 (12.5%)	188 (17.3%)
Inappropriate	92 (27.5%)	62 (22.3%)	62 (20.5%)	32 (19.0%)	248 (22.9%)

2.6 Discussion

In school-aged children (5 – 16 years) there are two peaks in incidence of presentation for burns to EDs, MIUs and BUs (5 and 11 years old (12.1% and 11.4% of all cases respectively)). The most frequent types of burn were scalds caused by the spilling of hot drinks/food and contact burns caused by touching of cooking appliances/ovens. Nearly eighty percent of cases had first-aid applied before presentation, but only 1.3% received optimum first-aid compliant with all steps of the BBA BFAT guidelines (2014).

Previously recognised trends suggest decreasing burn frequency with increasing age for school-aged children in the UK (Kemp et al., 2014; Tan et al., 2012). Previous studies including the examination of burns of school-aged children have suggested that burns occurring to older children are attributable to an increase in risk-taking behaviours combined with increased independence and autonomy (Kemp et al., 2014). The present data provide support for this risk hypothesis with the median age for flame, chemical and explosive burns at 12.3 years of age. However, flame, chemical and explosive agents only accounted for 1 in 10 burns. Around a half (50.9%, 552/1084) of burns in school-aged children were scalds and contact burns from hot water, drinks, food and food preparation. This may be explained by an increased autonomy in food and drink preparation. It is at these ages that children transition between primary and secondary school and often experience a shift in supervision (YouGov, 2011) and are more likely to be home alone after school. This trend is mirrored in other injury types. Although a majority of burn injuries are not life threatening, unintentional injury is the leading cause of death to adolescents aged 10 – 14 years and 15 – 19 years in high income countries with an increase of injuries such as motor vehicle crashes, bicycle injuries, severe cuts and falls (Sleet et al., 2010).

Data from the current suggest more females presented with a burn injury than males – especially for those aged 14 – 15 years. However most published data on the epidemiology of burns report this trend to be reversed (Ringo et al., 2014; Zhou et al., 2014; Brewster et

al., 2013; Taira et al., 2010; Nasser et al., 2009; Chipp et al., 2008; Khan et al., 2007; Rawlins et al., 2007). This may be due to differences in the populations studied. The trend of males being affected more than females is a global phenomenon and is reflected in all injury types (WHO, 2004) despite not being shown in our data. Explanations from studies have been offered relating to possible higher incidence of female burns in those countries and cultures when older girls are expected to help their mothers in the kitchen and therefore would be exposed to more potential sources of burns (Yates et al., 2011). This could be suggested from the presented data with a large amount of water and hot drink scalds from spills occurring whilst making/preparing food and drink in those aged 11 – 13 and 14 – 15 years.

First-aid data show that some form of first-aid was administered in nearly 80% of all cases within the sample, a level similar to that of findings from other studies of paediatric presentations to secondary care (Cuttle et al., 2009 (86.1%)). Although over half of those who received burns first-aid had attempted cooling with cold running water, the number with the correct mechanism of application and duration were low (cooling method appropriate = 25.6%, cooling duration appropriate = 14.8%, cover material appropriate = 17.3%). This, combined with the level of incorrect dressings applied lead to optimum first-aid being applied in just over one percent of the entire sample. This strongly suggests a need for population level education of appropriate burns first-aid.

2.6.1 Strengths and Limitations

Like systematic reviews, epidemiological studies underpin good clinical research and evidence-based medicine (Zaccai, 2004). Epidemiological studies of injury offer an insight into the predisposing and influential factors and causality, can be used to infer individual risk and are crucial to planning interventions that target the needs of the population and to allocate resources dependent on need (Zaccai, 2004).

Strengths of the current study include its unique and relatively large sample size (in comparison to previous studies with school-aged sub-sets e.g. Kemp et al., (2014) and Abeyasundra et al., (2011)) and its multicentre nature increasing generalisability of findings to a UK population. With data collection taking place across 17 EDs, MIUs and BUs in two UK countries a deeper understanding of the injury event for children in this age group could be compiled than before. Using a mixture of site types enabled the exploration of injuries presenting to different levels of treatment centres. As a majority of research to date on this topic has used inpatient data sets this study has been able to explore the patterns of those burns less serious that still present for medical assistance that may or may not require admission to secondary care units. The use of the CBRD also ensures that the data to be analysed is up-to-date providing an insight on the current trends in burn injury. As noted previously, this is crucial for prevention efforts as patterns of burn injury fluctuate as different agents and mechanisms trend in and out, and new come along. As well as this CBRD data is collected prospectively upon presentation by the examining physician reducing processing errors. All of this information enables us to have the most accurate knowledge to date on the needs of the population to develop targeted interventions and allocate resources effectively.

As with systematic reviews checklist documents exist to ensure that these studies are conducted and reported in a standardised and transparent manner. Dependant on the study design used the different checklists and statements can be used. Due to the design of the current study the STROBE Statement (Strengthening the reporting of observational studies in epidemiology) for cross-sectional studies was used to ensure that the methods, results and discussion met the current standards set by the STROBE statement (von Elm et al., 2008).

The main limitation of the current study was the variable ascertainment rates across data collections centres. The lowest centres were Wrexham (45%) and North Manchester (60 –

70%) whereas all others had ascertainment rates between 80 – 100%. This variation may have introduced ascertainment bias within the study (Spencer and Brassey, 2017). Another limitation is the level of missing data for some variables. Although good for a majority of the study parameters where missing data were infrequent, over 20% of data were missing for both the variable of TBSA and time of day the injury occurred. Due to both of these limitation results should be interpreted with caution and future efforts should be directed to the further education of physicians working in contributing sites as to when and how the BaSAT proforma should be filled in.

2.7 Chapter Summary

Results from this study found evidence to suggest that burns tend to increase in incidence at around at 11-years-of age; are primarily scalds (49.1%) and contact burns (34.3%) relating to the preparation, consumption and carrying/moving of hot food and drinks (46.4%), are more likely to occur to older children at the weekend, and 98.7% do not receive BFAT in line with BBA guidelines (2014).

These results, coupled with the poor methodological quality of existing evaluations of burn prevention interventions identified in chapter three, suggest there is a need for new prevention interventions for school-aged children. Unlike prevention in the younger ages, where prevention efforts target behavioural changes in parents/carers to reduce risk (e.g. placements of hot drink on low surfaces) (CAPT, 2016; Erdmann et al., 1991), these data suggest that due to the high incidence of burns by the spilling and touching of hot water and foods and food preparation, the content of a new intervention will need to focus on these mechanisms in children rather than parents.

Chapter Three: What interventions prevent unintentional burns in school-aged children? A systematic review

3.1 Chapter Introduction

Following the MRC guidance recommendations on the development of complex interventions (Craig et al., 2008), this chapter reports the results of the systematic review of scientific literature to identify what interventions prevent unintentional burns in school-aged children.

3.2 Background

As far as the author is aware the scientific evidence base for the efficacy of burn prevention interventions for school-aged children has not been systematically reviewed. The MRC Developing and evaluating complex intervention guidance (Craig et al., 2008) existing evidence (ideally in a systematic review) in the development phase. Collating such evidence in a systematic review enables researchers to suggest whether intervention likely to be effective, and consider lessons learned from previous research studies.

A comprehensive systematic review conducted in 1996 by Dowsell et al. first synthesised the evidence on what works for preventing childhood unintentional injuries. The review assessed interventions for the prevention of all injuries for 0 – 14-year-olds with no limit on setting. Results from the review suggest that some interventions were found to be effective at prevention such as bicycle helmet use, use of seatbelts in cars and provision of smoke detectors. The review suggested that the key to success of community-based campaigns was sustained use of surveillance systems, networks and co-operation between different

agencies and working groups. However, this review is dated now, and up-to-date evidence is of the most value for intervention development.

The more recent Cochrane Review by Orton et al. (2016) was the first to assess the effects of school-based educational programmes for the prevention of injuries in children and evaluate their impact of improving children's safety skills, behaviour and practices, knowledge and assess their cost-effectiveness. However, this review excluded studies of interventions that targeted one injury type or one injury mechanism (e.g. an intervention that targeted only scald or contact burns). Review exclusion criteria also meant that those interventions that did not have a school-based component or that were delivered in a community setting (such as youth clubs, social clubs or parenting groups) were not included. To address this gap a systematic review was conducted to assess the effectiveness of burn prevention interventions for school-aged children to inform the development of a burn prevention intervention for school-aged children.

This systematic review aims to:

- Examine the effectiveness of interventions in
    - increasing knowledge about how to prevent burns in school-aged children
    - improving attitudes about how to prevent burns in school-aged children
    - increasing burn prevention practices in school-aged children
    - preventing burn injuries in school-aged children
- Examine the acceptability and feasibility of interventions to participants, parents and other stakeholders

As reported in chapter one of this thesis there is a predominance of research into the prevention of burn injuries for those aged less than five years old and thus a majority of existing interventions are targeted at parents of younger children in the home environment. To date this existing evidence has been synthesised a number of times to explore the effectiveness of such interventions and parenting programs (Towner et al.,

2001; Kendrick et al., 2008; Kendrick et al., 2013; Wynn et al., 2014; Zou et al., 2015). Alongside this, epidemiological data reported in the previous chapter show increased incidence of burn injuries occurring during the preparation, consumption and movement of food and drink by the child, therefore interventions that target children specifically to increase their own prevention efforts are of primary interest. To this end only interventions delivered directly to children for the prevention of burn injuries will be included.

For this thesis no systematic review of BFAT teaching interventions was conducted. Previous recent systematic reviews (Van de Velde et al., 2009; Plant and Taylor, 2013; Reveruzzi et al., 2016) have identified best practice for teaching resuscitative and non-resuscitative first-aid to children. Results from these reviews were used to inform intervention development – this is explored in Chapter Four.

3.3 Methods

This systematic review was conducted and reported in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Moher et al., 2010), and the Cochrane Handbook for Systematic Review of Interventions (Higgins and Green, 2011).

3.3.1 Protocol and Registration

A protocol was developed prior to commencement of the review, with pre-specified methods of analysis and outlining the inclusion and exclusion criteria. The review was registered with PROSPERO (www.crd.york.ac.uk; record number: ID number - CRD42015016505). Since publication the review no longer includes any interventions targeting sunburn prevention only and has expanded to include non-school based interventions.

3.3.2 Eligibility Criteria

The eligibility criteria for inclusion and exclusion of studies into this review were defined using the PICOS process (**P**opulation, **I**ntervention, **C**omparator, **O**utcomes, and **S**tudy Design). Table 12 details the eligibility criteria for the review by PICOS. Study limits placed

on the search included those papers published in English (or where an English language version were available) and papers published from 1 January 1995 to 30 June 2017 (Table 12).

Studies from non-OECD countries (Organisation for Economic Cooperation and Development) were excluded as in OECD low- and middle-income countries (LMIC) children have a disproportionately higher rate of burns as those compared to those in high-income countries (HIC) (Peck, 2011). In LMIC paediatric burn aetiology and pattern of injury differ from those in HIC due to exposure to different burn hazards (whether that be in the home environment or occupational environment) (Peck, 2011). Those studies of interventions tailored to participants with specific complex needs (such as special education needs) or specific cultural traits (such as interventions designed for the Amish community) were also excluded as they could not be generalisable to the greater population.

The age of compulsory state-based education varies across the world. For this review all studies evaluating interventions delivered to children aged four to fifteen completed years of age were included (and those that included an over-lap of participants aged three with the target population). Age ranges of compulsory education by OECD country as reported by their state governing body are provided in Appendix 28.

The review includes burn prevention interventions for school-aged children that are delivered both within the school environment and in non-school based settings. This decision was made as excluding interventions delivered in a non-school based setting could exclude some valuable data that could help answer the research question; often interventions delivered in other settings have a similar format and organisation when group-based and the method of transferring prevention knowledge and skills between the intervention delivery setting and the home environment is the same for school and non-school settings.

Table 12 - Eligibility criteria for studies

	Inclusion	Exclusion
Population	School-aged students were four to fifteen completed years (or those that included an over-lap of participants of children of a pre-school and school-age)	Adults who are parents/carers of school-aged children All of the intervention or population were delivered in a non-OECD country/ies Those solely with complex needs or those who have specific cultural traits (reducing generalizability)
Intervention	Individual or group-based interventions aimed specifically at the prevention of unintentional burns in school-aged children	Intervention not related to the prevention of burns Nature of burn being prevented is solely sunburn Intervention aimed at parents/carers or teachers Intervention relates to the clinical management of burn/scalds
Comparator	Comparator/control group that have either not received the intervention at all, received an alternative intervention or alternative school-based curricular activities, delayed receipt of the intervention or have completed baseline outcomes prior to intervention completion	No comparator group
Outcomes	Self-reported or medically attended unintentional burn injuries Self-report or practical burn injury prevention safety practices (assessed by children conducting safety practices or observed by adults) Burn injury prevention knowledge (assessed from children) Burn injury prevention attitude (assessed from children)	Intentional or inflicted burn injuries Clinical management of injuries Outcome measures based solely on parental self-report, behaviour, attitude or practice No outcome measures reported Outcome measures do not address the aim/s of the systematic review

Study Design	Primary research studies including all study designs with a comparative element (e.g. randomised and non-randomized control trials, cluster randomised control trials, before and after studies)	Study designs with no comparative element Review articles, secondary or tertiary research studies
Study Limits	Published between January 1st 1995 and June 30th 2017 English language studies	

2.3.3. Information Sources and Search

Searches of literature from 1995 onwards were conducted on MEDLINE, MEDLINE in-process, EMBASE, PsycINFO, HMIC (Health Management Information Consortium), SCOPUS, Social Policy and Practice, ASSIA (Applied Social Sciences Index and Abstracts), ERIC (Education Resources Information Centre), Trophi (EPPI centre database), Pubmed epub ahead of publication and clinicaltrials.gov. Additional studies were identified through snowballing techniques including reference list checking of included studies, contact with experts, citation tracking and hand searching of the top five journals ranked according to publications of evaluations of paediatric injury and paediatric burn injury interventions (Journal of Burn Care and Research, Pediatrics, Burns, Health Education and Injury Prevention). Searches of literature prior to 1995 were deemed to be unrepresentative of the current school environment, and the previous review by Dowsell et al. (1996) had examined what worked for preventing childhood unintentional injuries (age range of children in studies included = 0 – 14 years, intervention delivery in all settings).

The search strategy is outlined in Appendix 29 and was devised in collaboration with Cardiff University's Specialist Unit for Review Evidence (SURE) group. The search strategy was developed in the database Ovid MEDLINE and adapted for other electronic databases.

The primary search of electronic databases and all other sources of information were initially carried out in October 2015. An updated search was carried out on 30 June 2017 (a citation alert was used thereafter to ensure there were no major omissions prior to thesis

submission). A search log was maintained detailing the names of the databases searched, the database coverage, date of search, search terms used and search results. Titles and abstracts of studies to be considered for retrieval were stored in an electrical reference management system software (Endnote X7; Thomson Reuters, Philadelphia, Pennsylvania).

3.3.4 De-duplication of citations

Due to the retrieval of duplicate records across the searched databases and hand searching exercises electronic de-duplication was conducted, followed by manual deduplication by Harriet Quinn-Scoggins (HQS). Where duplicate records were identified they were discarded. In situations where two or more publications contained duplicate or partial duplication of data, the publications that contained results most relevant to this systematic review were selected and the others discarded.

3.3.5 Study Selection

The screening assessment for eligibility occurred in two phases. Phase one included title and abstract screening by HQS against the systematic review's inclusion and exclusion criteria (Table 12). All citations identified by the search following de-duplication were screened. Any titles that did not meet the inclusion and exclusion criteria were rejected. The second phase of screening involved the critical appraisal of those remaining full-text publications by two reviewers (HQS and either Dr Verity Bennett (VB), Dr Sabine Maguire (SB) or Lucy Hoskyns (LH)) with the use of a standardised critical appraisal tool (Critical Appraisal Skills Programme Randomised Control Trial Checklist (2017) and Cohort Study Checklist (2017)) [Appendix 30 & 31]. If reviewers disagreed on the result of the appraisal a discussion was held and a consensus reached, if a consensus could not be reached a third reviewer was consulted who made the final decision.

The Critical Appraisal Skills Programme checklists were used as they aid the reviewers to assess the internal validity, results and relevance to practice of proposed studies. The CASP checklists were developed using a formal four-stage process by an interdisciplinary working

group and are advocated for use in reviews on public health topics for evidence-based practice (National Collaborating Centre for Methods and Tools, 2018).

3.3.6 Data Collection Process

HQS extracted the data from included studies; a second reviewer independently checked the extracted data for accuracy (LH or VB). Data were extracted on to a standardised data extraction form in Microsoft Excel (Microsoft Office, 2016). Table 13 reports all the data extracted from included studies. Any disagreements that arose were resolved by consensus between the two reviewers. If no consensus could be reached a planned third reviewer were approached for a decision. Where studies addressed more than one type of injury, only data relevant to the review question (i.e. burn injury data) were extracted. Where studies occurred in more than one country only data from those OECD countries were extracted, if this were not possible the study was excluded. Where available quantitative results data were extracted under the following headings: knowledge, attitude, practice. 'Other' results (quantitative or qualitative) were also extracted. This included data relating to feasibility and acceptability of the study, or any other results or comments deemed important by the research team.

3.3.7 Data Items

Table 13 reports all data extracted from included studies.

Table 13 - Details of data extracted from included studies

Data Extracted	
Basic Study Information	Authors; Title; Journal; Year; Country in which the research was conducted
Population	Number of participants; Age range of participants; Socio-demographic data pertaining to participant or their family (details of personal or family socioeconomics, education, race, ethnicity)
Methods	Study design; Aim of study; Outcome measures; Inclusion and exclusion criteria; Duration of study; Recruitment methods; Sources of bias
Intervention	Intervention name; Nature of burn injury being prevented; Theoretical or educational basis of the intervention; Intervention type, description and content; Information on intervention materials or any additional materials (such as for take-home exercises or parent information sheets); Whether any preparatory research had been conducted prior to current study
Results	All quantitative and qualitative results pertaining to knowledge, attitude or practice
Limitations	Limitations noted formally by the publication or by the researcher
Other Comments	Any results on the feasibility and acceptability of the program at any level. Any other comments thought appropriate to note by the researcher

3.3.8 Quality assessment across studies

Quality of studies was assessed using the Effective Public Health Practice Project's 'Quality Assessment Tool for Quantitative Studies' (Effective Public Health Practice Project, 1998). The tool was completed independently by HQS and (LH or VB) researchers. A score of 'strong', 'moderate' or 'weak' is attributed to the study in each of the following areas: selection bias, study design, confounders, blinding, data collection method, withdrawals and dropouts. A final decision on the quality of the paper was attributed to the study by both reviewers, a global rating. If the reviewers disagreed on the quality standard attributed to the paper discussions were held and a consensus was reached; if no

consensus could be reached a third reviewer was consulted who made a final decision. Global ratings for papers were attributed as follows: 'Strong' = no weak ratings across the assessment fields, 'Moderate' = one weak rating, 'Weak' = two or more weak ratings (Effective Public Health Practice Project, 1998).

The Effective Public Health Practice Project's 'Quality Assessment Tool for Quantitative Studies' was chosen to be used as an aid to conduct quality assessment across studies as the instrument was developed for use in public health, to address the need to assess evidence that can support practice and has been advocated for use in injury prevention and minimisation studies (National Collaborating Centre for Methods and Tools, 2018). The standardised tool, alongside the user manual and dictionary, has been evaluated for content and initial construct validity and inter-rater reliability (National Collaborating Centre for Methods and Tools, 2018). When evaluated the tool met validity and reliability accepted standards (Thomas et al., 2004).

3.3.9 Classification of Intervention Types

Interventions were classified by intervention type as devised by HQS and LH. Classifications were: curriculum or educational schemes of work, play or game based, safety village, individual educational sessions. Definitions of intervention types are detailed in Appendix 32.

3.3.10 Data Analysis

Due to high levels of heterogeneity of outcome measures of included studies a meta-analysis was not conducted, and a narrative synthesis was performed using guidance outlined by Popay et al. (2006).

3.4 Results

3.4.1 Study Selection

Figure 11 shows the PRISMA flowchart describing study inclusion and exclusion. Electronic database searches identified 3,991 citations. An additional twenty-five studies were identified through other searches (including reference list checking, contact with experts, citation tracking and hand searching top five journals). Following electronic and manual deduplication 2,874 remained. All studies identified through other searches were also identified by the electronic database and thus removed at deduplication. Of these, 2,821 were discarded following title and abstract screening as they did not meet the inclusion criteria. Fifty-three full-text publications were retrieved and screened. Of these, 41 papers did not meet the inclusion criteria. Twelve papers were included, contributing 13 research studies, from 11 interventions.

One paper (Lamb et al., 2006) contains two separate studies within one paper – for the purpose of this review the two studies have been separated and will be referred to hence forth as Lamb (S1) and Lamb (S2). Two papers are part of the same research program – Moore et al. (2004) is the follow-up study of the Harre and Coveney (2000) study one-year post-intervention delivery.

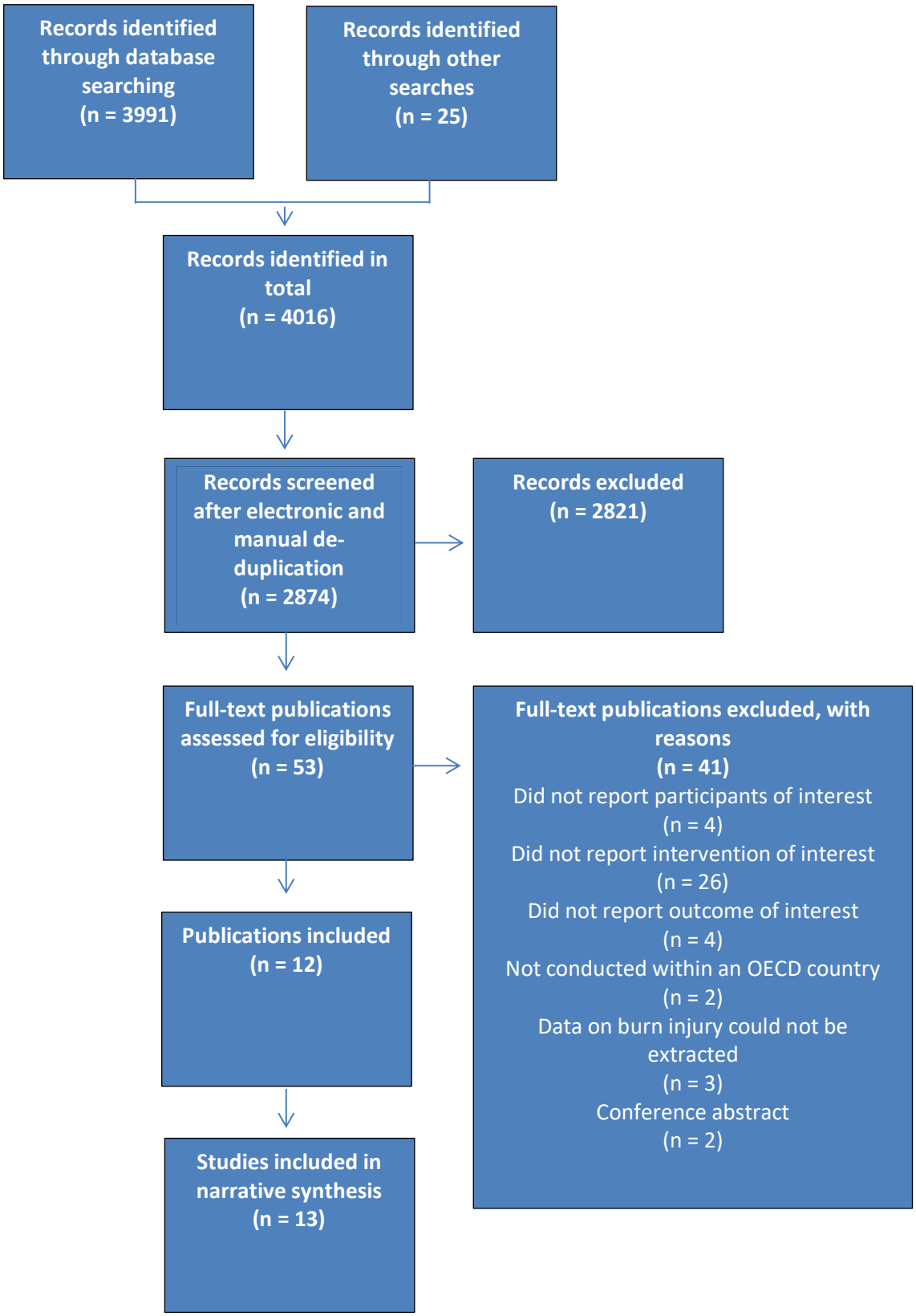


Figure 11 - PRISMA flow diagram of study selection process

3.4.2 Study Characteristics

Appendix 33 reports detailed characteristics of included studies. Table 14 provides a brief summary of the study characteristics of information contained within Appendix 33, and Table 15 provides a brief summary of the intervention, it's components, duration and results (positive, neutral or negative) by prevention domain assessed (knowledge, attitude and practice). The studies were undertaken in the USA (n = 5), UK (n = 3), New Zealand (n = 2), Canada (n = 1) and USA and India (n = 1) (only data from the USA were extracted). One study was an individually randomised control trial (Morrongiello et al. 2012), two were cluster randomised control trials (Kendrick et al, 2007; Morrongiello et al. 2016), two were non-randomised control studies (Frederick et al. 2000; Lamb (S1) et al. 2006), four were controlled before and after studies (Harre and Coveney, 2000; Azeredo and Stephens-Stidham 2003; Lamb (S2) et al. 2006; Chavez et al. 2014), three were before and after studies (Mondozzi and Harper, 2001; Sinha et al. 2011; Lehna et al. 2013).

Table 14 - Brief characteristics of included studies

First author and year of publication	Country of origin	Study design	Age (years) and number of participants	Intervention delivery site	Name of intervention	Intervention type	Burn type
Azeredo 2003	USA	CBAS	5 – 11 n = 6,3000	School	•	Curriculum/Educational scheme of work	Fire-related burn and home safety
Chavez 2014	USA	CBAS	3 - 4 and 7 - 8 n = 166	Community	Danger Rangers Fire Safety Curriculum	Curriculum/Educational scheme of work	Fire-related burn
Frederick 2000	UK	NRCS	10 - 11 n = 1,292	School and Community	The Injury Minimisation Programme for Schools	Curriculum/Educational scheme of work	Fire-related burn
Harre 2000	NZ	CBAS	5 - 11 n = 135	School	•	Curriculum/Educational scheme of work	Scalds
Moore 2004	NZ	Retention follow-up study (from Harre)	10 - 11 n = 116	School	•	Curriculum/Education scheme of work	Scalds
Kendrick 2007	UK	cRCT	7 – 10 n = 459	School	Risk Watch	Curriculum/Educational scheme of work	Fire-related burn and cooking safety
Lamb (S1)* 2006	UK	NRCS	10 – 11 n = 145	Community	Lifeskills	Safety Village	Fire-related burn and home safety

Lamb (S2)*	UK	CBAS (with additional retention testing)	10 – 11 n = 671	Community	Lifeskills	Safety Village	Fire-related burn and home safety
Lehna 2013	USA	BAS	5 – 13 n = 500	School	Hazard House	Individual educational session	Fire-related burn and general burn safety
Mondozzi 2001	USA	BAS	7 – 8 and 9 – 10 n = 338	School	The Firefighter's Game and Smokey's House Game	Play or game based	Fire-related burn
Morrongiello 2012	USA	RCT	3.5 – 6 n = 76	Community	The Great Escape	Play or game based	Fire-related burn
Morrongiello 2016	CAN	cRCT	4 – 6 n = 135	School	The Safety Detective Program	Curriculum/Educational scheme of work	Fire-related burn, cooking safety and general burn safety
Sinha 2011	USA & IND (only data from USA extracted)	BAS	5 – 7 n = 74	School	Tales of Burn Safety	Play or game based	Fire-related burn, fireworks and burn safety in the home

*Lamb – two studies are reported within one paper. For the purpose of this review the study characteristics and results have been separated into 'S1' and 'S2'.

RCT = Randomised Control Trial, CBAS = Controlled Before and After Study, cRCT = Cluster Randomised Control Trial, NRCS = Non-randomised Control Study, BAS = Before and After Study

USA = United States of America, UK = United Kingdom, CAN = Canada, IND = India, NZ = New Zealand

Table 15 - Brief intervention overview and effect of intervention (positive, neutral or negative) by prevention domain assessed

First author and year of publication	Intervention delivery site	Intervention Type	Intervention overview	Effect of intervention (prevention domain tested)
Azeredo 2003	School	Curriculum/Educational scheme of work	18 or 27 week curricula and lesson plans for kindergarten – grade 1, 2 – 3, 4 – 5; smoke alarm give away; school bicycle fairs with helmet give away; safety penpal letters for third grade students; letters to parents and injury prevention talks at parent-teacher meetings. Lessons are 30 – 45 minutes.	Positive (knowledge)
Chavez 2014	Community	Curriculum/Educational scheme of work	Danger Rangers Fire Safety Curriculum Curriculum and intervention divided into pre-kindergarten – kindergarten, 1st to 2nd grade and 3rd grade to increase age appropriateness. Intervention delivered for four hours a day at a summer day camp for one week (five days).	Positive (knowledge and practice)
Frederick 2000	School and Community	Curriculum/Educational scheme of work	The Injury Minimisation Programme for Schools The intervention programme is delivered to 10 – 11 year olds within the school curriculum and a hospital visit. Teachers are provided with an IMPS education resource pack for five months. Teachers are asked to have completed the basic core elements, before the second stage (hospital visit).	Positive (knowledge and attitude)
Harre 2000	School	Curriculum/Educational scheme of work	The intervention was a kit of materials provided for schools. The intervention included two lessons (approximately 45 minutes in length) and five homework exercises. The format of the class began with a discussion followed with use of a flipchart to present key ideas including how and why children are being burnt in the home, risk awareness and prevention ideas. Five homework exercises were	Positive (knowledge)

			distributed involving the child and parent identifying the whether items and their household practices were safe concerning them using a tick box exercise sheet (6 pages). If their actions were unsafe they were asked to alter them – if not, they were ask to provide their reasons for not doing so.	
Moore 2004	School	Curriculum/Education scheme of work	Following the evaluation of the intervention above the program was rolled-out in the same manner as above with the additional use of a stove sticker, a bath hook and a drink coaster for use at home.	Neutral (knowledge) Positive (practice)
Kendrick 2007	School	Curriculum/Educational scheme of work	Risk Watch Risk Watch folders and Risky Boxes are supplied to schools containing teaching resources, materials, teacher and student information. Included folders are targeted to years 3 and 4, with one to year 5. Folders cover eight topic areas - one of which is fire and burns. Participating schools taught at least one Risk Watch topic of their choice from the four chosen for evaluation.	Positive (knowledge and practice)
Lamb (S1)* 2006	Community	Safety Village	Lifeskills A safety education village. Children visit for 2 hours, rotating around 10 safety sets containing hazards in groups of three or four children with one adult. Children are encouraged to spot hazards and discuss ways of eliminating or avoiding them.	Positive (knowledge and practice)
Lamb (S2)*	Community	Safety Village	Lifeskills As above	Positive (knowledge and practice)
Lehna 2013	School	Individual educational session	Hazard House	Positive (knowledge)

			A model house (a 3D portable unit with lights that simulate fire and smoke) and presentation from local firefighters. Using a remote to light-up each room fire hazards were identified, discussed and corrections suggested with students. Intervention took approximately 30 minutes. Following the intervention students were provided with a fire safety checklist to take and use at home.	
Mondozzi 2001	School	Play or game based	The Firefighter's Game and Smokey's House Game The Firefighter's Game is a sheet game for classroom use. Smokey's House Game is a board game for two to six players. It was suggested that games were placed in the school library so as classes could check them out. Games were also provided to fire service providers to use when attending schools.	Positive (knowledge)
Morrongiello 2012	Community	Play or game based	The Great Escape An interactive cartoon computer game distributed to parents via CD-Rom for children to play on their home computer. Game used at home over a three-week period. Children are given the task of helping a playful animal out of various fire-hazard situations. Game is narrated by Mrs. Aboutfire who teaches the children about fire safety and guiding on correct and incorrect choices in different scenarios.	Positive (knowledge)
Morrongiello 2016	School	Curriculum/Educational scheme of work	The Safety Detective Program Six lessons covering six topics approximately 40 mins each. Each session has three activities: storybook, song and craft/game. Activities set-up in a circuit – children make their way around each in small groups, with a wrap-up at the end re-visiting main messages and safety slogan is rehearsed together. Children are provided a take-home activity. Parents provided with an information sheet.	Positive (knowledge)

Sinha 2011	School	Play or game based	Tales of Burn Safety Comic book read aloud in class – students read along with the teacher (approximately 35 min including pre- and post-test).	Positive (knowledge)

*Lamb – two studies are reported within one paper. For the purpose of this review the study characteristics and results have been separated into 'S1' and 'S2'.

3.4.3 Participant Characteristics

Appendix 33 reports detailed participant characteristics of included studies. Across the 13 studies, there were a total of 9,277 participants; with a range of 74 (Sinha et al. 2011) to 6,300 participants (Azeredo and Stephens – Stidham, 2003). The majority of studies (n = 7) had less than 200 participants. All studies included both males and females.

The youngest age of participants was three to four years, up to the eldest at thirteen years. A majority of studies included participants with a range of ages, often relating to school age groups due to intervention design. All studies were for those in the 'primary school age' ('elementary school' in the USA) or younger. There was only one participant aged over 11, a student aged 13 who re-took first and second grade (Lehna et al., 2013).

Other sample characteristics reported in papers included race/ethnicity/decent (Harre and Coveney, 2000; Moore et al. 2004; Morrongiello et al. 2012; Chavez et al. 2014), past history of burn (Chavez et al. 2014), socio-economic indicators at school level (Harre and Coveney, 2000; Moore et al. 2004), socio-economic indicators from parents/family (e.g. family does not have a car or annual gross household income) (Kendrick et al. 2007; Morrongiello et al. 2012), education indicator level from parents/family (Morrongiello et al, 2012) and whether the child had a younger sibling (Moore et al. 2004). Other studies matched populations on school characteristics such as location, size and national curriculum test results (Frederick et al. 2000; Lamb (S1) et al. 2006; Lamb (S2) et al. 2006).

3.4.4 Intervention Characteristics

Appendix 33 reports detailed intervention characteristics of included studies, Table 15 reports a brief overview. Intervention delivery occurred in schools for eight of the interventions (Harre and Coveney, 2000; Mondozzi and Harper, 2001; Azeredo and Stephens-Stidham, 2003; Moore et al. 2004; Kendrick et al. 2007; Sinha et al. 2011; Lehna et al. 2013; Morrongiello et al. 2016); in the community for four studies (Chavez et al. 2014; Lamb (S1) et al. 2006; Lamb (S2) et al. 2006; Morrongiello et al. 2012) and mixed school and

community settings for one study (Frederick et al. 2000). Community settings included a summer camp (Chavez et al. 2014), a visit to a hospital (Frederick et al. 2000) the 'Lifeskills' education village (Lamb et al. 2006) and the home environment (Morrongiello et al. 2012). Interventions addressed fire-related burns in four studies (Frederick et al. 2000; Mondozzi and Harper, 2001; Morrongiello et al. 2012; Chavez et al. 2014), scalds in two studies (Harre and Coveney 2000; Moore et al. 2004), three studies addressed fire-related burn and home safety (Azeredo and Stephens-Stidham, 2003; Lamb (S1) et al. 2006; Lamb (S2) et al. 2006); Kendrick et al., (2007) addressed fire-related burn and cooking safety, Morrongiello et al. (2016) fire-related burn, cooking safety and general burn safety and Sinha et al (2011) fire-related burn, fireworks and burn safety in the home (Sinha et al, 2011). A mixture of qualitative and quantitative data collection and analysis procedures were used.

A majority of interventions were curriculum or educational schemes of work (n = 7) (Frederick et al., 2000; Harre and Coveney, 2000; Azeredo and Stephens-Stidham, 2003; Moore et al., 2004; Kendrick et al., 2007; Chavez et al., 2014; Morrongiello et al. 2016), one was a visit to a safety village (Lamb (S1) et al., 2006; Lamb (S2) et al., 2006), one was an individual educational session (Lehna et al., 2013) and three were play/game based interventions (Mondozzi and Harper, 2001; Morrongiello et al. 2012; Sinha et al., 2011). Take home materials were utilised in five of the interventions; homework exercises for participants were provided by Harre and Coveney (2000) and Moore et al. (2004), a safety checklist by Lehna et al. (2013), a letter to parents by Azeredo and Stephens-Stidham (2003) and a parent information sheet and a take home activity by Morrongiello et al. (2016).

3.4.5 Intervention Development

Azeredo and Stephens–Stidham (2003) was the only study to report the theoretical basis of the study, conduct a pilot (included study), assess teachers' acceptability of the

intervention, revise the intervention in-light of pilot findings, discuss adoption within the local curriculum and conduct a process evaluation. No other studies reported any formal feasibility testing, piloting or prototyping of the intervention before taking it forward to an effectiveness trial.

Morrongiello et al. (2016) was the only study to report the theoretical behavioural change basis of the intervention in depth. The intervention, 'The Safety Detective Program' was based on the findings from education psychology, child development and The Health Belief Model (Becker, 1974). Azeredo and Stephens-Stidham (2003) report using learning, behavioural and socialisation theories to develop the intervention, though further details on how they were applied is not provided.

Harre and Coveney (2000), and subsequently Moore et al. (2004), were the only studies to conduct a survey prior to intervention development to assess what activities school-aged children (7 – 13 years) were engaged with that carried a burn injury risk. They used the results from this study to tailor the intervention. Azeredo and Stephens-Stidham (2003) and Sinha et al. (2011) report that the interventions was based on epidemiological evidence, however no evidence is provided for this.

Three studies reported on the learning mechanisms (a process or system used to produce a particular result i.e. mechanisms of change) utilised within the intervention. Lamb (S1) and (S2) et al. 2006 report that 'Lifeskills' is underpinned by the ethos of learning by doing, however no further supporting evidence or discussion is provided for this. Morrongiello et al's (2012) 'The Great Escape' is reported to utilise the mechanisms of repetition, interactivity, problem solving, positive feedback and self-evaluation.

Three studies reported collaboration in the development of the intervention. The intervention in Chavez et al. (2014) was developed in collaboration with classroom teachers, Frederick et al. (2000) with healthcare professionals and Kendrick et al. (2007)

collaborated with stakeholders when adapting 'Risk Watch' for the UK (originally developed in USA).

3.4.6 Effectiveness of interventions in increasing knowledge about how to prevent burns

All 13 studies assessed the effectiveness of interventions in increasing knowledge of how to prevent burns. Twelve showed a statistically significant improvement. Knowledge outcome measures used across studies were highly diverse, with a variety of question formats (often a series of multiple-choice questions), some used a scoring scale (single item), or visual/pictorial assessments (none of which were validated). Detailed results for changes in knowledge across all studies are presented in Appendix 34.

Three randomised controlled trials evaluated changes in burns knowledge. In Morrongiello et al. (2012) participants were presented pre- and post-intervention with 19 hypothetical house-fire scenarios using a dolls house and asked to demonstrate their knowledge of key messages using figures to act out how they would respond, and a further two key messages were assessed using photographs (a fire fighters mask, and how fires grow and spread) (n = 76, intervention = 36, control = 40). Scenarios were filmed and later coded to obtain a summary fire knowledge score by two independent researchers who coded half of all participant videos (randomly assigned) as well as an additional 25% cross-over to assess interrater reliability. For each question a score of 0 (incorrect answer), 0.5 (correct answer given after prompting), or 1 (correct answer given without prompt) was assigned. Scores were summated indicating a greater degree of fire safety knowledge. Scores were converted to percent correct (out of 100%) for analyses. A significant increase was reported for the intervention group from pre- to post intervention score for overall correct score across time ($p<.01$), whilst there was no significant change in overall percent of correct score across time for the control group ($p>.05$). A significant group x time interaction ($p<.05$) suggested the intervention improved knowledge.

In Kendrick et al. (2007) knowledge was assessed using a pre- and post-intervention questionnaire, with knowledge questions illustrated pictorially with the requirement of ticking boxes or circling hazards (n = 459, intervention = 240, control = 219). Post-intervention those who had received the burn specific module had a significantly higher percentage score (percentage of correct responses) than those in the control (p = .01) and the intervention was more effective in increasing fire and burn prevention knowledge amongst younger than older children (difference between means age 7 = 19.5%, age 8 = 9.3%, age 9 = 5.4%, age 10 = 3.8%; p =.04).

In Morrongiello et al. (2016) those in the intervention group scored significantly higher than those in the control group at post-intervention (p<.001) for overall percent correct score on the photograph-sorting task (n = 135, intervention = 93, control = 42). Understanding of injury risk also showed a significant improvement between groups post-intervention (p<.001). Understanding of injury risk was assessed on the depth of participants understanding of the injury issue. Scores were assigned based on depth of understanding of the issue. Scores per photo ranged between 0 – 4 (0 = unrelated to safety, 1 = unclear, 2 = general safety concern, 3 = specific safety concern, 4 = understanding the specific injury consequence). Scores for explanations were summated with higher scores indicating greater understanding. This score was then divided by the number of photographs to yield an average score for understanding.

3.4.7 Effectiveness of intervention in improving attitudes about how to prevent burns

One study by Frederick et al. (2000) evaluated a specially produced video depicting an evolving story of a group of children engaged in a series of risky behaviours and showed a significant improvement for participants identifying and responding to electrocution risk five months post-intervention (intervention = 102, control = 40, p<0.1) and for not playing with a magnifying glass (intervention = 30, control = 13, p<0.1).

3.4.8 Effectiveness of interventions in increasing burn prevention practice

Five studies reported data on the effectiveness of the intervention in increasing burn prevention behaviours (Harre and Coveney, 2000; Moore et al. 2004; Lamb (S1) et al. 2006; Kendrick et al. 2007; Chavez et al. 2014). Two studies used outcomes based on participants demonstrating safety skills (Lamb (S1) et al. 2006; Kendrick et al. 2007), two used self-reported measures of home safety actions (Harre and Coveney, 2000; Chavez et al. 2014) and one used both parent and participant self-report measures of home safety actions (Moore et al. 2004). Results are reported in Appendix 10.

In the two studies which observed participants demonstrating safety skills, Kendrick et al. (2007) used a series of participant safety skills using role-play of injury scenarios and self-report safety behaviours. Eight participants from each school (n = 144) were randomly sampled for safety skill assessments. Intervention participants demonstrated a significantly higher percentage of correct safety skills compared to control participants (difference in means of percentage demonstrating correct fire burn prevention skills = 8.93 (95% CI 1.67, 47.78), p = .01) and were also more likely to self-report never playing with matches compared to control (OR 1.84,95% CI 1.06 to 3.20).

Lamb et al (S1) (2006) assessed burn prevention behaviour through a series of real-life equivalent scenarios of those from the Lifeskills training set (n = 145, intervention = 109, control = 36). Participants received one point for each of the scenarios for which they had all correct features. Performance scores were summated. Intervention group participants passed a significantly higher number of the five performance tests than those in the control group (mean number of tests passed intervention = 1.91, control = 0.93, p<.001). The intervention group scored significantly higher marks/ratings in the tests for 'gas – should do' (what should be done in the event of a gas leak) (percentage of participants correct on all features, intervention = 27%, control = 6%, partial x^2 = 8.81), 'gas – never do' (what

should never be done in the event of a gas leak) (intervention = 22%, control = 3%, partial x^2 = 9.92) and 'fire escape routine' (intervention = 11%, control 0%, partial x^2= 7.20) compared to control (p <.01); however no difference was reported for 'kitchen hazards' where both intervention and control groups scored over 80% (intervention = 86%, control = 81%, partial x^2= 0.57).

3.4.9 Effectiveness of interventions in preventing burn injuries

None of the studies assessed whether their interventions prevented burn injury occurrence.

3.4.10 The acceptability of interventions to participants, parents and stake holders

The acceptability of the intervention was assessed in seven studies (Frederick et al. 2000; Harre and Coveney, 2000; Mondozzi and Harper, 2001; Azeredo and Stephens-Stidham, 2003; Kendrick et al. 2007; Morrongiello et al. 2012; Lehna et al. 2013). Of these, none of the studies assessed acceptability to participants directly. Results are reported in Appendix 10.

Two studies had instructor reports of participant's enjoyment and engagement of the intervention. Lehna et al. (2013) instructors reported that children really enjoyed the intervention - they listened and interacted with the Hazard House effectively.

Questionnaires assessing ease of implementation of the games, clarity of the games, and whether concepts were easily understood were completed by 55% of schools (n = 15/27) in the Mondozzi and Harper (2001) study. Results report that 67% of teachers rated the student's interest in the games (The Firefighter Game and Smokey's House Game), as 'excellent', and 33% as 'good'.

Mondozzi and Harper (2001) also reported teacher feedback on the intervention and implementation within their class. Teachers stated that the games were colourful and encouraging, that some questions in the game evoked a lot of interest, some questions

needed additional definition for terms. All teachers (n = 15) agreed that the games were fairly simple and fit into the class agenda.

Azeredo and Stephens-Stidham (2003) explored acceptability of the intervention training, intervention content, activities and usefulness of materials to teachers and principals (n = 78, 83% of those involved). Results from Likert scale assessments reported acceptability of content, activities and usefulness of materials to teachers and principals with mean scores of 5.8, 5.5 and 5.4 respectively (where 1 was poor, and 7 was excellent).

Two studies briefly explored acceptability to parents. Harre and Coveney (2000) reported (from parental questionnaires) that 55% parents who completed the questionnaire reported that the take home exercises (a package of five activities) that were conducted as part of the intervention were enjoyable for themselves, and 80% reported that they were enjoyable for their child. However, as Harre and Coveney (2000) do not report how many questionnaires were administered or completed it is hard ascertain the importance of these responses. Parental questionnaires used in Frederick et al. (2000) (n = 180) report that 97% of parents thinking that the intervention (IMPS) should be made available to all schools.

No studies reported outcomes on acceptability to stakeholders such as health professionals, public health agencies or fire and rescue agencies.

3.4.11 Quality Assessment of Studies

Nine of the thirteen studies included were assigned a global rating of weak in accordance with the Effective Public Health Practice Project's 'Quality Assessment Tool for Quantitative Studies' (Frederick et al. 2000; Harre and Coveney, 2000; Mondozzi and Harper, 2001; Azaredo and Stephens-Stidham, 2003; Moore et al. 2004; Sinha et al. 2011; Morrongiello et al. 2012; Lehna et al. 2013; Chavez et al. 2014), three were moderate (Lamb (S1) et al., 2006; Lamb (S2) et al., 2006; Kendrick et al., 2007) and one was strong (Morrongiello et al., 2016) (Appendix 11). Whilst only the quality of one study was assessed to be weak for

study design (Lamb (S1) et al., 2006), and four for withdrawals and dropouts (Mondozzi and Harper, 2001; Azeredo and Stephens-Stidham, 2003; Sinha et al, 2011; Chavez et al. 2014), 6 out of 13 were weak within all other domains (selection bias, confounders, blinding and data collection method). Of the three included RCTs one was assessed to have a strong rating (Morrongiello et al. 2016), one moderate (Kendrick et al. 2007) and one weak (Morrongiello et al. 2012).

3.5 Discussion

To the author's knowledge the present review was the first to systematically review the scientific literature around the effectiveness of interventions in the prevention of unintentional burns for school-aged children. The review was conducted in accordance with guidance from the Cochrane Handbook for Systematic Review of Interventions (Higgins and Green, 2011) and PRISMA guidelines (Moher et al., 2010).

Eleven of the thirteen studies included focused some, or all of their prevention messages, on fire-related burn injuries. Twelve of the 13 studies included reported significant increases in burn prevention knowledge, the one study that measured attitude showed it to be effective at improving attitudes about how to prevent burns. Out of the five that measured behaviour, two improved burn prevention behaviours. None evaluated effects on the prevalence of burns or subsequent burn injury rates in the studied population. Brief evidence was provided for the acceptability of burn prevention interventions. Crucially no studies asked students' themselves what they thought of the intervention, and only one study briefly assessed implementation and acceptability of the intervention to teachers (Mondozzi and Harper, 2001). When developing school-based interventions it is essential that the intervention is deemed to be acceptable and feasible to the population

(students, parents and teachers) as the implementation of interventions can often be undermined by problems of acceptability (MRC, 2000).

No studies assessed intervention effect on the prevention of burn injuries. According to the quality assessment, the majority of evaluations were classified as weak, with only three RCTs. Overall there was very little detail provided on how the interventions were developed or tested for feasibility. For example, none cited the framework that they followed to develop the intervention. Azeredo and Stephens-Stidham provided the most detail but the level provided would still not meet the required information set by the TIDieR Checklist for Better reporting of interventions (Hoffmann et al., 2014). Morrongiello et al. (2016) cited a theory that the intervention was based upon, none showed a logic model or described the process of development or feasibility testing.

The low quality of evaluations means that although prevention programs were found to improve knowledge and attitudes there is limited confidence in these evaluations. With a predominance of controlled and uncontrolled before and after studies there is limited ability to provide unbiased estimates about the effectiveness of the intervention as these study designs have been recognised to overestimate the benefit of interventions (Goodacre, 2015). This is similar to previous review findings suggesting injury prevention interventions for school-aged children could have a positive impact on knowledge, behaviour and skills but more evidence of a higher quality is needed (Dowsell et al., 1996; Royal et al., 2005; Nauta et al., 2014; Orton et al., 2016; Salam et al., 2016). This suggests more studies using a robust randomised design are needed.

The lack of detail on how studies are developed, their content and materials make it hard to assess whether they are (and how they are) targeting the correct burn injuries for the population. Aside from the implicit assumption that improved knowledge about burns may encourage the adoption of safer behaviours around burn hazards, and therefore prevent burns, the underlying causal mechanisms which these interventions seek to disrupt are

unclear. Without program logic models, the inputs, intermediate child-, parent-, or school-level process, and short- and long-term outcomes are unclear. The MRC developing and evaluating complex interventions guidance (Craig et al., 2008) suggests before a test of effectiveness, interventions should be clearly developed, and tested for feasibility, before piloting. It is important that interventions are not prematurely tested for effectiveness and that they are properly refined and prototyped.

3.5.1 Age and Injury Type

Although the search included studies of those aged 4 – 15 completed years (or those with additional pre-school age participants), included studies only covered those 3.5 – 13 years of age (with only one participant aged above 11 years; one student was aged 13 in Lehna et al. (2013)), the primary school age (5 – 11 years in the UK). This predisposition of included studies highlights a lack of unintentional burn and scald injury prevention interventions for those in secondary schools (11 – 16 years; middle/high school in USA), not only within the UK but across OECD countries. This finding is mirrored within Salam et al's (2016) systematic review of interventions to prevention unintentional injuries among adolescents. Eleven of the thirteen studies included focused some, or all of their prevention messages, on fire-related burn injuries. It could be argued that this focus does not match the current epidemiological patterns of burn and scald injuries sustained by school-aged children in high-income countries. Epidemiological studies have reported a predominance of scald and contact burn injuries occurring in the 5 – 16-year-olds (Quayle et al., 2000; Kemp et al., 2014). Although it is likely that fire-related burn injuries still account for higher mortality and morbidity rates than other burn types in the age-group due to their severity they are less frequent events, and death is often a consequence of smoke inhalation rather than burn injury; especially in high-income countries (WHO, 2008).

3.5.2 Additional Materials and Methods of Engagement

Five studies included materials to either take home or keep at home. A variety of additional materials and objects were provided across studies to reiterate messages provided by the

intervention or provide practical solutions for prevention in the home. Take home materials may provide a bridge to gain greater exposure of content from school-based interventions to the home. The provision of such materials may also work to increase behavioural compliance of educational interventions (Christoffel and Gallagher, 2006). Take home materials attempt to engage adults (e.g. when homework exercises are to be completed with a parent/carer) to achieve additional reach and impact of the intervention.

3.5.3 Development of Interventions

Few of the included studies referred to having used behavioural change theories, learning theories, or epidemiological studies to develop the intervention. Although many studies provided information on burn incidence, prevalence and risk factors within their respective backgrounds, little information was provided on how these were used to inform the age group that the intervention was delivered to. The only study to describe this was that of Harre and Coveney (2000), and subsequently Moore et al. (2004). The survey prior to intervention development enabled tailoring of the intervention to the needs of the population as they identified the burn injury risks and targeted them during the intervention. Although this is a relatively small study (Harre n = 135, and later Moore n =116) the scientific process followed was accurate and revisions were made following the first intervention delivery, with additional effectiveness testing and retention testing. Three studies reported collaboration in the development of the intervention. The importance of involving children, families and communities in formulating injury prevention programmes, as well as using a multi-disciplinary approach to deliver them, has been noted by Mulvaney (2012) and Orton et al. (2016) as being a progressive step in injury prevention research. Collaboration itself can be seen as a complex intervention (Lawson, 2004). Collaboration has the potential to yield multiple benefits (e.g. effectiveness, efficiency, resources, capacity, legitimacy and the identification of barriers and facilitators of

implementation) but problems can also emerge (e.g. imprecision, incoherence and competing conceptions and agendas) (Lawson, 2004).

3.5.4 Educational Content of Interventions

In general, novel and interactive teaching methods were used in the more recent studies. For example, Morrongiello et al. (2012) used a computerised cartoon game and Lehna (2013) used a 3D model home that could simulate a house fire using lights and smoke. Interactive teaching methods are useful as they not only provide information, but teach problem-solving skills (Collins, 1981). Activities should be age-appropriate and in older age-groups often uses technology-based interventions, compared to stories and craft-based exercises for younger students.

3.5.5 Strengths and Limitations

Systematic reviews are invaluable tools for evidence-based medicine. Systematic reviews condense empirical evidence, limit bias, improve reliability and accuracy for rational decision making at scientific, policy and practice levels (Murlow, 1994). Crucially, it is hoped that analysis can establish whether findings can be generalised across populations and settings (Murlow, 1994). Tools (such as checklists), guidance and registration databases exist to ensure that reviews are consistently and transparently conducted and reported within the scientific community.

Strengths of the review include that a protocol for the review was developed alongside the SURE team at Cardiff University prior to commencement and registered on the PROSPERO database. Registration on the international prospective register at inception helps to avoid duplication of reviews and reduce reporting bias. Following this, the review was conducted and reported in-line with the PRISMA guidelines (Moher et al., 2010), and version 5.1.0 of the Cochrane Handbook for Systematic Review of Interventions (Higgins and Green, 2011). Use of the PRISMA checklist and flow diagram ensures that the reported results meet the evidence-based standard expected. Use of the Cochrane Handbook for Systematic Review of Interventions ensures that the review met the explicit systematic methodological

requirements of the review type. This includes defining the review question and PICO framework to assess eligibility of studies, systematic searching for studies, study selection and data extraction (by two independent reviewers where appropriate), assessing risk of bias in included studies (by two independent reviewers), analysing data and undertaking analysis, addressing reporting biases and the presentation and interpretation of results (Higgins and Green, 2011). Further guidance was consulted due to the conduction of a narrative synthesis of results (Popay et al., 2006).

Another strength of this review is the extensive search. The systematic search included an electronic search of 12 databases (containing scientific, educational and social science primary data papers and registered trials), hand searching the top five journals, reference list checking of included papers, citation tracking and contact with experts. The use of these different search techniques across the academic arenas was crucial to ensure that the search was sensitive and as studies may have been reported in journals covering different academic disciplines.

Due to the adherence of the available guidelines and checklists the review would be considered to be of a good quality according to the AMSTAR 2 checklist (A Measurement Tool to Assess Systematic Reviews, (Shea et al., 2017)). However, limitations do exist. Only those papers published in English were included in the review; therefore, it is possible that non-English language papers meeting the inclusion criteria could have been excluded. To best counteract this English language versions of papers were sourced where possible. A time-parameter was also placed on the study to not include those papers published prior to 1995; therefore, it is possible that relevant evidence published prior to this date could have been excluded. The time-parameter was placed to increase generalisability of results by setting – it was deemed that studies conducted in schools before this date would not be representative of the 21st century classroom, and results from previous publications were comprehensively synthesised by the work conducted by Dowsell et al. (1996).

A common theme throughout the included studies was a lack of information provided on how the schools were recruited to participate. This lack of information made it hard to accurately assess selection bias and therefore generalisability to the population of school children.

3.6 Chapter Summary

This systematic review found evidence that prevention interventions for unintentional burns in school-aged children can be effective across the areas of knowledge, attitude and practice. However, due to the poor methodological quality in the conduct or reporting in these studies no overarching elements of what is effective in school-age burns prevention could be identified and results should be interpreted with caution. The review has highlighted that there is a research gap surrounding the scientific development (in accordance with the MRC developing and evaluating complex intervention guidance (Craig et al., 2008)) and appropriate reporting of intervention development and content (according to the 2014 TIDieR Checklist for Better reporting of interventions by Hoffmann et al. 2014) and an absence of intervention programs that have been evaluated for school-aged children focusing on scald and contact burns. There is also a gap in interventions targeted to the older school child (11 years and above, secondary school age in the UK) and a lack of interventions that evaluate burn injury rates.

Chapter Four: Intervention Development

4.1 Chapter Introduction

This chapter reports on the process used to create the Learn About Burns intervention. Intervention development followed the MRC guidelines for the development and evaluation of complex interventions (Craig et al., 2008). First the intervention program logic model is presented, followed by how results from previous chapters (i.e. chapter two, an epidemiological study and chapter three, a systematic review) alongside existing theory, informed the development of the intervention logic model, content and method of delivery. The intervention is then presented in line with the template for intervention description and replication (TIDieR) checklist and guidelines (Hoffman et al., 2014).

4.2 Background

As discussed in chapter one, the MRC guidance for the development and evaluation of complex interventions (Craig et al., 2008), suggests that complex interventions should be developed and evaluated in an iterative process. In chapter two, following the MRC guidance, an epidemiological study was presented on a cross-sectional data collection of burn injuries to EDs, MIUs and BUs, to identify the most prevalent behavioural targets and agents. In chapter three, a systematic review of interventions was conducted to identify existing interventions that prevent unintentional burns and scalds for school aged children. An intervention logic model is presented with discussion provided on how results from previous chapters (combined with PPI exercises) informed development of the intervention.

4.3 Learn About Burns Logic Model

The final step in the MRC developing and evaluating complex interventions guidance (Craig et al., 2008) development pathway is to model the initial proposed intervention processes and outcomes. To do this a Learn About Burns logic model was developed (Figure 14). ”Logic models provide a means of presenting a program and establishing process and outcome goals” (Julian, 1997:251). The proposed logic model maps the activities and predicted mechanisms of action to the outcomes. Both forward and reverse logic strategies were utilised iteratively to combine knowledge gained from pre-development activities (systematic review, epidemiological study and PPI exercises) and the purpose/mission of the intervention: to prevent childhood burns and increase correct use of BFAT. Forward logic strategies refer to movements from left to right across the logic model; starting from inputs and asking a series of ‘if then’ questions until outcomes/impact are reached (GHCP, 2013). Reverse logic strategies refer to movements from right to left across the logic model; starting from outcomes/input and asking a series of ‘but how’ questions until inputs are reached (GHCP, 2013).

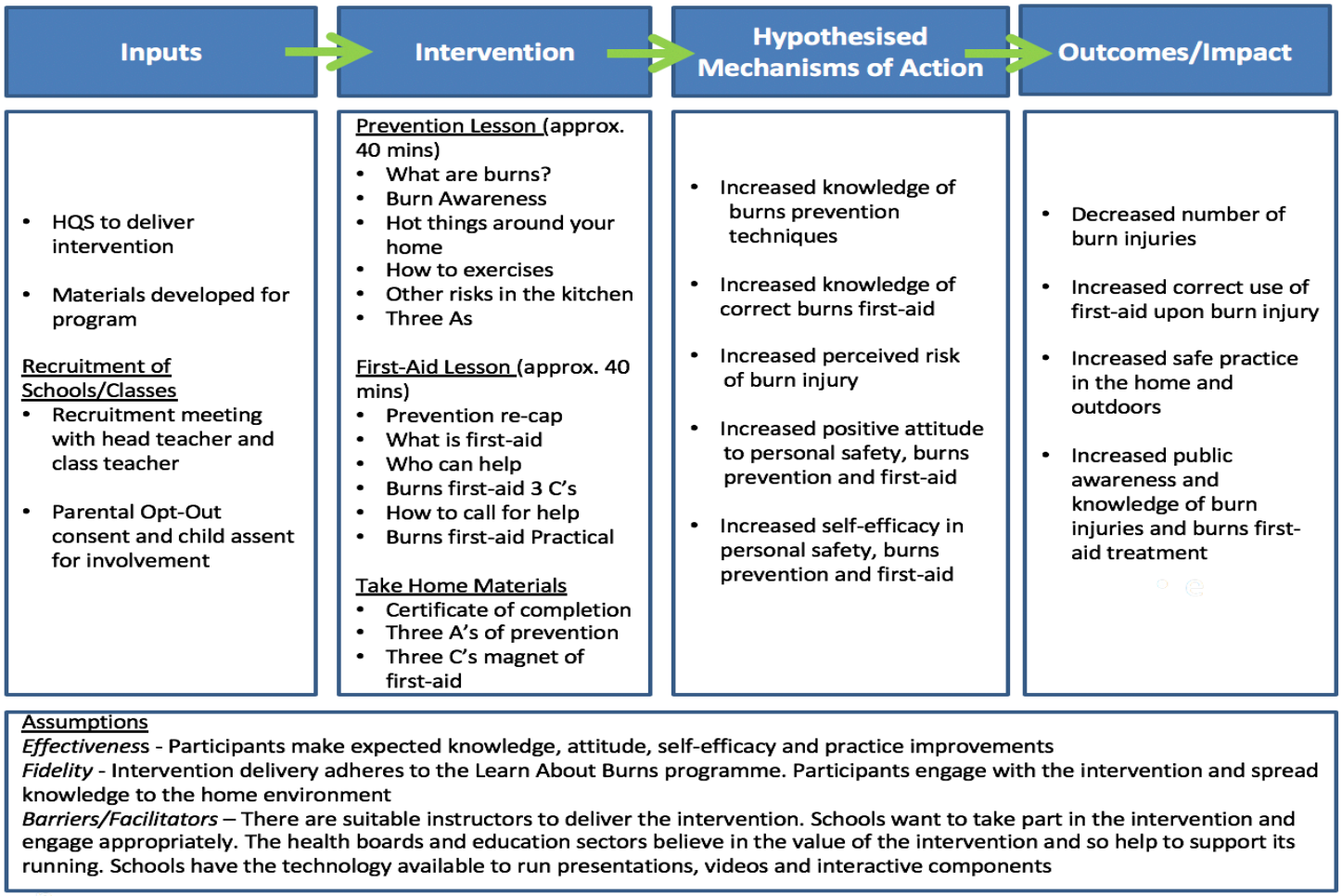


Figure 12 – Learn About Burns intervention logic model

4.4 Intervention Development

4.4.1 Knowledge from previous studies and existing theory used to inform the logic model

4.4.1.1 Epidemiology (Chapter Two)

As reported in chapter two a cross-sectional epidemiological study was conducted on the 'Patterns of burns in school-aged children' to inform which agents and mechanisms the intervention should target. The aim was to identify highest risk age groups, agents and mechanisms of burn injuries to ensure these are covered by the intervention. These results suggest an increase in prevalence around 11-years-old at 11.4% of all injuries occurring at this age. The burns effecting children aged 11 were primarily scalds and contact burns relating to the preparation, consumption and carrying/moving of hot food and drinks. These burns often occurred after school or at the weekend, and did not receive appropriate BFAT.

4.4.1.2 Systematic Review (Chapter Three)

As reported in chapter three, a systematic review was conducted to collate knowledge from previous studies on 'What interventions prevent unintentional burns in school-aged children?'. Results from this study found evidence to suggest that burn prevention interventions for school-aged children can be effective across the areas of knowledge, attitude and practice; however due to poor quality of studies and differing outcome measures what interventions work could synthesised. Although results from the review were inconclusive lessons can be learnt in that:

1. It's important to assess acceptability of the intervention to parents, teachers and wider school staff (Harre and Coveney, 2000; Azeredo and Stephens-Stidham, 2003; Lehna, et al., 2013)
2. Interventions should target the agents and mechanisms that are of the highest risk to the given population (Harre and Coveney 2000; Moore et al., 2004);

3. Novel and interactive interventions are often used in a variety of learning environments (Kendrick et al., 2007; Lehna et al., 2013; Morrongiello et al., 2016)
4. Use of take-home materials may help snowball intervention to increase intervention reach and impact (Harre and Coveney, 2000; Moore et al. 2004; Lehna et al., 2013).

4.4.1.3 Existing Knowledge from Previous First-Aid Systematic Reviews

As reported in chapter three a systematic review exploring how best to teach first-aid to children was not conducted due to existing evidence synthesis and knowledge of best practice. Three systematic reviews (Van de Velde et al., 2009; Plant and Taylor, 2013; Reveruzzi et al., 2016) identified the following principles that increase the effectiveness of first-aid education that have been incorporated into the intervention:

- Programs that include training for participants in overcoming inhibitors of emergency helping behaviour can lead to improved delivery of first-aid and higher helping rates
- Instruction/training that include hands-on practice to enable children to perform physical tasks and skills and didactic approaches are the most effectivee
- Repeated training can improve delivery of first-aid and retention (though questions still exist on the format and frequency needed of the repetition sessions to be most effective)
- Facilitators should be trained in first-aid delivery

4.4.1.4 Patient and Public Involvement Exercises

Identified as an important aspect of the development of interventions (Bagley et al., 2016), a series of PPI exercises were undertaken with students, teachers, parents, third parties and stakeholders (e.g. South Wales Fire and Rescue Service, Welsh Network of Healthy Schools) to enable collaborative intervention development. PPI exercises are an important

aspect in the development of complex interventions to ensure that interventions are appropriate, user-relevant, user-friendly and consumer-focused (Brett et al., 2014; Andrew et al., 2015). This element is important and follows the United Nations Conventions on the Rights of the Child (1989) endorsing the participatory rights of children with research that is conducted on their lives; thus advocating 'research with children' rather than 'research on children' (Bell, 2008). This participatory element of intervention development can be useful as children have a unique standpoint and view on their lives and lived experiences. Results from each PPI exercise were fed-back iteratively into the study design and intervention development process throughout the PhD. No formal qualitative analysis were undertaken of data, instead recordings were listened back to in order extrapolate views and key points made or discussed.

PPI Exercise One – Focus Group Tables (November 2014)

The first PPI exercise was in the format of focus groups organised by the wider Cardiff CBRN team in November 2014. Local parents, teachers and stakeholders were invited to an afternoon or morning session to gain their feedback on current research projects in the team. Each research project or idea had a table and in small groups of approximately 4-6 participants they rotated around each table to every 20-25 minutes. A table was set-up for this study and informal feedback was gathered via Dictaphone from participants on:

- Their views on the proposed development of a school-based burn injury prevention intervention for schools, whether they thought it was important and if it was something they would be supportive of
- Any top tips for engaging students, teachers, schools, parents and stakeholders in the future
- Initial thoughts regarding format and how it may map to the curriculum and fit into school timetables

- What they felt was needed and wanted to reduce burn injuries to children
- Would any ages/year groups have strict barriers to access, or would such an intervention be more suitable to some ages/year groups

Overall 40 participants took part in the table discussion throughout the day (25 parents, 5 teachers and 10 stakeholders (stakeholders represented South Wales Fire and Rescue Service, Welsh Network of Healthy Schools, specialist burns nurses and specialist burns outreach nurses).

PPI Exercise Two – Presentation and Discussion with Bridgend Cubs (January 2015)

The second PPI exercise included the delivery of a presentation (very brief) to the 2nd Bridgend Cubs group and an open discussion led by Cub group members. The presentation introduced the researcher and the overall aims of the study and the open discussion was used to gain feedback from the group on what they think is important to target, materials and exercises that they would find most engaging and informative and novel ways to engage children their age on the topic of injury prevention and safety. Twenty one Cubs were present at the group, nine of which were female.

PPI Exercise Three – Presentation and Discussion with Stakeholders at the bi-annual Welsh Network of Healthy Schools Cardiff Meeting (June 2015)

The third PPI exercise included the delivery of a presentation and discussion with teachers attending the bi-annual Welsh Network of Healthy Schools Cardiff Meeting in June 2015. Eighteen primary school teachers from a variety of schools within the East South Wales locality attended. The presentation delivered covered the proposed format of the intervention and data collection tools. Primarily teachers were asked to feedback on their thoughts of the proposed intervention format and draft materials. Teachers were asked to

comment on usability, readability, sensitivity and engagement of materials, and any barriers they could identify in the format of the intervention for delivery in schools and classroom settings.

PPI Exercise Four – Pop-Up for National Burns Awareness Day (October 2015)

The fourth PPI exercise was a pop-up stand in the concourse of the University Hospital of Wales on National Burns Awareness Day (October 2015). The pop-up stand and table displayed draft materials that would be used as part of the intervention, and the researcher used an iPad to show videos developed as part of the intervention as appropriate. The researcher engaged parents/carers and children who took an interest in the pop-up stand to gain feedback on the materials. Participants (adults and children) were asked what their overall opinion was of the materials, whether they were easy to understand, what they thought the main message they were trying to get across was and whether they thought they were age-appropriate for the population (8 - 9year olds). Throughout the day feedback was gained from 15 adults and 12 children.

4.4.1.5 Educational Theories and Learning Styles

As the results of the systematic reviews did not indicate which methods of delivery were most effective, the literature on educational theories and learning styles was examined to inform intervention activities and content. Educational theories, often referred to as 'learning theories', are conceptual frameworks describing how knowledge is absorbed, processed, and retained during learning. 'Learning styles' differ in that they explore "the manner in which individuals choose to or are inclined to approach a learning situation" (Cassidy, 2004:420).

Four main educational theories are recognised: behaviourism, constructivism, socio-linguistics and cognitive/information processing, with two orientations: those that are

teacher-centred, and those that are student-centred (Aubrey and Riley, 2015). Current teaching within the UK education system advocates student-centred learning with an emphasis based on constructivism (Korcova, 2007). Student-centred learning (sometimes referred to as 'learner-centred approaches') is teaching:

- that engages students in the act of learning;
- that motivates and empowers students by giving them some control over the learning process;
- that encourages collaboration, acknowledging the classroom to be a community;
- that promotes students to reflect about what they are learning and how they are learning it;
- that includes explicit learning skills instruction (Weimer, 2013).

Constructivism denotes that people construct their own understanding and knowledge of the world through personal experiences and social interactions; we are active creators of our own knowledge. Learners create knowledge by relating or connecting it to their previous knowledge; a process of continued reflection and appraisal. Therefore, cognitive growth is initiated when learners are confronted with practical, contextual or personal problems that present situations that require a new way to think (Pelech and Pieper, 2010). Constructivism is encouraged through asking questions, exploring ideas and assessing new knowledge against what we already know and our pre-conceptions.

In the classroom environment and through class exercises/activities these concepts and theories are often reflected through encouraging children to use active techniques to create new knowledge (i.e. doing experiments and problem-solving exercises) and then participate in discussion on how and why their new knowledge is changing their understanding in a cyclical process. It is important to understand the recognised learning experiences of students, as transfer of knowledge (defined as the ability to extend what has

been learned in one context to another) from one environment or situation to another is vital for interventions to be successful (Broudy, 1977).

4.4.1.6 Behaviour Change Techniques

It was not until relatively recently that behavioural science was recognised to be integral to injury prevention strategies (Gielen and Sleet, 2003), due to the previous notion that structural and environmental changes can lead to higher number of injuries prevented compared to individual or social behavioural changes. Such behavioural changes require individuals to take an active role in changing their behaviour to increase safety despite existing hazards in the environment (Gielen and Sleet, 2003). Selection of behaviour change techniques are situation-specific, audience-specific, setting-specific and dependent on the characteristics that need to be changed. In the development of this intervention The Behaviour Change Technique Taxonomy (BCT-Taxonomy, 2019) was used to identify techniques appropriate for use given the situation, audience and setting of the intervention. The Behaviour Change Technique Taxonomy is a consensually agreed, reliable taxonomy that can be used across a number of disciplines (Michie et al., 2013). The below behaviour change techniques were identified enable the hypothesised mechanisms of action identified in the intervention logic model (Figure 12):

- Problem Solving - analyse, or prompt the person to analyse, factors influencing the behaviour and generate or select strategies that include overcoming barriers and/or increasing facilitator
- Commitment – ask the person to affirm or reaffirm statements indicating commitment to change the behaviour
- Instruction on how to perform a behaviour – advise or agree on how to perform the behaviour (includes 'Skills training'
- Information about health consequences – provide information (e.g. written, verbal, visual) about health consequences of performing the behaviour

- Salience of consequences – use methods specifically designed to emphasise the consequences of performing the behaviour with the aim of making them more memorable
- Anticipated regret – induce or raise awareness of expectations of future regret about performance of the unwanted behaviour
- Demonstration of the behaviour – provide an observable sample of the performance of the behaviour, directly in person or indirectly e.g. via film, pictures, for the person to aspire to or imitate
- Social comparison – draw attention to others' performance to allow comparison with the person's own performance
- Credible source – present verbal or visual communication from a credible source in favour of or against the behaviour
- Verbal persuasion about capability – tell the person that they can successfully perform the wanted behaviour, arguing against self-doubts and asserting that they can and will succeed

Where each of these techniques is used in the intervention materials and activities is reported in Table 16.

4.5 Intervention description and rationale using the TIDieR framework

Information provided to meet the requirements of the TIDieR framework is presented in the grey boxes. Additional information on the rationale and development of the intervention is presented as standard text.

4.5.1 Item 1. Brief Name

Learn About Burns. A school-based burns prevention and first aid program.

The name 'Learn About Burns' was developed in conjunction with colleagues in the CBRN. The name was chosen as it provided clear information about the content and intention of the intervention, it was short and snappy, and to the researchers knowledge was not previously in-use and was easily understood and favoured by students, parents and teachers during PPI exercises.

4.5.2 Item 2. Why

Research presented within this thesis has shown the dearth in evidence-based prevention interventions available for school-aged children to address their increased risk of sustaining burn injuries in the home when preparing or consuming hot food or drinks. The Learn About Burns intervention hopes to address this gap to increase burn prevention knowledge, attitude, self-efficacy and practice of students in both burn prevention and burns first-aid.

The aim of the intervention is to:

- Decrease the number of burn injuries
- Increase the correct use of burns first-aid upon injury occurrence
- Increase safe-practices in the home and outdoors
- Increase positive attitude and self-efficacy for delivery of burns first-aid when appropriate
- Increase public awareness and knowledge of burn injuries and burns first-aid treatment

The intervention aims to do this by:

- Increasing knowledge of burn prevention techniques
- Increasing perceived risk of burn injury
- Increasing knowledge of burns first-aid treatments
- Increasing positive attitudes to personal safety, burns prevention and burns first-aid treatment
- Increasing self-efficacy in personal safety, burns prevention and burns first-aid treatment

4.5.2.1 Rationale for why the intervention was developed

Chapters one (introduction), two (epidemiological study) and three (systematic review) have highlighted the existing gap in evidence-based interventions for the prevention of burns for the school-aged population. Research has shown that school-aged children have little knowledge of burn risks and hazards, alongside little knowledge of appropriate BFAT to perform if injuries do occur. Burn injuries also occur most frequently to those from socio-economically deprived backgrounds; therefore, a school-based intervention, if delivered effectively, can be of a scale to derive population level change for all students (Dewhirst et al., 2014; Denman et al., 2002). The aim of the intervention is to try to address that gap by:

- Increasing knowledge of burn prevention techniques;
- Increasing perceived risk of burn injury;
- Increasing knowledge of burns first-aid treatments;
- Increasing positive attitudes to personal safety, burns prevention and burns first-aid treatment;
- Increasing self-efficacy in personal safety, burns prevention and burns first-aid treatment.

In order to:

- Decrease the number of burn injuries;
- Increase the correct use of burns first-aid upon injury occurrence;
- Increase safe-practices in the home and outdoors;
- Increase positive attitude and self-efficacy for delivery of burns first-aid when appropriate;
- Increase public awareness and knowledge of burn injuries and burns first-aid treatment.

Year 4 were chosen to be the target year-group for the intervention. The British National Curriculum defines children within Year 4 to be 8 – 9 years (British Government, Department for Education and Learning, 2017) (inclusive of all children who have their ninth birthday between 1st September and 31st August of the prospective academic year).

Results from the epidemiological study suggest an increase in burn prevalence around 11-years-of-age. Targeting Year 4 enables the delivery of the intervention to participants before the increase in incidence of burn injuries. Year 4 was also advocated to be appropriate through PPI exercises with teachers for the following reasons:

1. Higher level of flexibility within the curriculum to allow the inclusion of the intervention due to lack of formal state assessments;
2. Students are mature enough to engage appropriately and sensitively with the topic;
3. 'The body' is commonly taught as a theme in Year 4 within schools that teach a topic-lead curriculum; therefore, the topic of the intervention runs parallel with, and compliments, the current focus of learning.

The older age-group (secondary school age, 12-16 years) was not chosen due to lower incidence of injury following the second peak prevalence at 11-years-old. Consideration was also given to feedback provided by teachers on constrained timetable of the secondary curriculum (even more so than that of primary) and intricacies of access to schools and poor previous engagement of key gate-keepers such as Healthy School Scheme leaders.

4.5.3 Item 3. What – Content, Materials and Procedures

The intervention includes two group-based lessons (40 – 45 minutes long each) for students aged 8 – 9 years old. The first lesson covers burn and scald prevention content, the second lesson covers BFAT. Intervention materials include two PowerPoint presentations (with integrated videos), practical exercises and participant take home materials. Table 15 provides a list of materials, a brief description of what they are and how and when they are used.

Delivery of the intervention needs to be approved by the school Senior Management Team (SMT) and class teachers. Time for the lessons needs to be allocated in the curriculum on two consecutive weeks. The facilitator needs to discuss the intervention (either face-to-face or via telephone) with the class teachers and appropriate members of the SMT two weeks prior to intervention delivery to discuss intervention basis and content, and the environmental and technological requirements for delivery.

PowerPoint presentations and activities provide the structure of the lessons, around which small group discussion and questions are encouraged. Each lesson is split into three phases: a starter activity, development activities and a round–up. A starter activity acts as an introduction, development activities form the main content of the lesson through the format of a series of activities and round-up activities provide a review and closing of the session.

The only additional procedure for the facilitator outside of the lesson is to gather the participants 'Three A's' activity slips (lesson one, round-up activity). Slips are retrieved from pupils to be laminated before the being returned to pupils at the end of lesson two.

Table 16 - Learn About Burns intervention materials. When and how they are used.

Materials		Brief Description, When and How Used	Behaviour Change Techniques
PowerPoint Presentation	PowerPoint 1	Lesson One: Burn and Scald Prevention Embedded videos: Thermal imaging videos - 1. How long does it take hair straighteners to cool down? 2. How long does it take a cup of tea to cool down? 3. How long does it take a hot water bottle to cool down? How to videos – 1. How to safely make a hot drink 2. How to safely fill a hot water bottle 3. How to take something out of the microwave. Used to structure lesson, deliver content and provide a basis for discussion and questions of session one	• Problem solving • Instruction on how to perform a behaviour • Information about health consequences • Salience of consequences • Anticipated regret • Demonstration of the behaviour • Social comparison • Credible source • Verbal persuasion about capability
	PowerPoint 2	Lesson Two: Burns First-Aid Embedded video: How to video – 1. Burns first-aid Used to structure lesson, deliver content and provide a basis for discussion and questions of session two	• Problem solving • Instruction on how to perform a behaviour • Information about health consequences • Salience of consequences • Anticipated regret • Demonstration of the behaviour • Social comparison • Credible source

			• Verbal persuasion about capability
Practical Exercises	Hot things around your home	Development activity, lesson one Nine students will be asked to place a picture of either a mug, hair straighteners or a hot water bottle on a timeline to show how long they think it will take their item to cool down until it reaches a safe temperature	• Problem solving • Credible source • Verbal persuasion about capability
	Making a hot drink	Development activity, lesson one Students will be used to demonstrate how much a kettle should be filled to make one hot drink, how to safely make a cup of tea and to show how the liquid from one cup will go if spilt	• Problem solving • Commitment • Instruction on how to perform a behaviour • Salience of consequences • Demonstration of behaviour • Social comparison • Credible source • Verbal persuasion about capability
	Filling a hot water bottle	Development activity, lesson one A student will be asked to demonstrate how to safely fill a hot water bottle	• Problem solving • Commitment • Instruction on how to perform a behaviour • Salience of consequences • Demonstration of behaviour • Social comparison • Credible source • Verbal persuasion about capability

	Other risks in the kitchen	Development activity, lesson one Students are asked in small groups to discuss how other objects/appliances in the home may cause burn injuries to them or any younger siblings, and how they might avoid these injuries from occurring	• Problem solving • Verbal persuasion about capability
	Hot things around your home (2)	Starter activity, lesson two In pairs students are asked to write down as many burn hazards as they can remember in each room of the house from the previous lesson	• Verbal persuasion about capability
	Cool timeline	Development activity, lesson two Three students will be asked to place a tap on a timeline to show how long they think a burn injury should be cooled for	• Problem solving • Credible source • Verbal persuasion about capability
	How to call for help	Development activity, lesson two Two students will be asked to roleplay how they would call for help and answer (one acting as the caller, one as the emergency operator)	• Problem solving • Instruction on how to perform a behaviour • Demonstration of behaviour • Social comparison • Credible source • Verbal persuasion about capability
	How to cover a burn	Development activity, lesson two A student will be asked to demonstrate with the trainer how to cover a burn wound. All students will then be asked in pairs to practice on each other. Students will be provided with a number of materials.	• Problem solving • Instruction on how to perform a behaviour • Demonstration of behaviour • Social comparison • Credible source • Verbal persuasion about capability

Take Home Materials	My Three A's of Prevention	Round-up activity, lesson one Provided for student completion	• Commitment • Credible source
	Burns First Aid Fridge Magnet	Round-up, lesson two Provided for students to take home	• Instruction on how to perform a behaviour • Salience of consequences • Demonstration of the behaviour • Credible source
	Certificate of Completion	Round-up, lesson two Provided for students to take home	• Verbal persuasion about capability

4.5.3.1 Rationale and development of intervention content, materials and procedures

4.5.3.1.1 Content

A detailed description of both lessons can be found in Appendix 36 & 37, and lessons plans in Appendix 38 & 39. Full PowerPoint presentations and videos have been provided on the memory stick provided alongside this thesis. Screen shots of PowerPoint presentations are also provided in Appendix 40 & 41.

Intervention content was devised following the inception of learning objectives for the two sessions as reported and discussed below. 'Learning objectives' are nomenclature within education and refer to what students should know or be able to do by the end of a set time-frame (Briggs et al., 2008). The use of the term 'learning objectives' was used to increase relatability and clarity for students and teachers. Learning objectives were based on outcomes of the logic model (Figure 12). However, not all logic model outcomes had directly associated learning objectives i.e. 'increase knowledge' or 'increase attitude', but were appropriately covered in each lesson and targeted through specific behaviour change techniques. As learning objectives were student facing it was important to use objectives that they could easily understand, relate to and were in-line with nomenclature that there are used to within their school learning environment.

4.5.3.1.1.1 Burn Prevention

Learning Objectives for the burn prevention lesson are as follows –

By the end of the lesson, students will be able to:

- Understand the difference between a burn and a scald;
- Recognise different ways that children could burn themselves at home;
- Understand and be able to act upon key prevention messages for common household burns.

The majority of burn prevention interventions are aimed at adults (including parents and/or carers) (Kendrick et al., 2009; Wynn et al., 2014); or have a focus on fire related burn (as highlighted in the results of the systematic review presented in chapter three); so there was little existing intervention content that could be repurposed. Therefore, novel burn prevention messages were developed that addressed the burn risks to children aged 8 – 12 years using simple language and instructions. Messages were devised from:

- those existing from evidence based third-sector parties and organisations including the Children's Burns Trust, The Royal Society for the Prevention of Accidents and The BBA;
- discussions and consultations with teachers and paediatric injury prevention specialists (based in both Cardiff University and University of Bristol).

Prior to use, all prevention messages were discussed with parents/carers and children during opportunistic PPI exercises to ensure appropriateness and understanding of the target audience.

Results of the epidemiological study show that a majority of burn injuries occurring to children within the target age group related to the preparation, consumption and carrying/moving of hot foods and drinks (40.6% of burn injuries to 11 – 13-year-olds). To address these, three exemplary scenarios (made into how-to-videos) were chosen to form the main teaching and content components (with additional activities providing further examples and reiteration of key prevention messages). The main scenarios include - making a hot drink, filling a hot water bottle and how to take something hot out of the microwave. These scenarios were chosen as:

- They incorporated common burn agents and mechanisms of injuries occurring to children within the target age group as identified through the epidemiological study;

- They included a range of burn injury types and risks (contact burns and scalds; hot water, steam, tea, hot water bottle, hot soup and a hot bowl);
- They addressed a range of mechanisms including food preparation/consumption, pouring of hot liquids and the use/carrying/moving of burn injury agents;
- They are relatable to everyday tasks within the home;
- They corresponded to acts commonly performed at different times of the day to highlight that burn risks are present throughout the entire day (i.e. hot drinks are often prepared in the morning, soup is often consumed at lunchtime and hot water bottles in the evening);

Although not all injury mechanisms and agents highlighted within the intervention related to the highest incidence of injuries from the epidemiological study (e.g. scalds from hot water bottles and contact burns from hair straighteners) they represented agents and mechanisms that were attributable to a large number of injuries (scalds from hot water n = 252/1084 (23.2%, of all injuries ages 5 – 15 years) and hair styling devices n = 60 (5.5%) (Appendix 29) as they were exemplary of the factors identified above and could be built into a story that was relatbable to the population.

The use of three short scenarios enabled the development of a burn risk narrative to be built and transferred and repeated in relation to different tasks. The use of home-based scenarios enables pupils to consider the transference of knowledge learnt in school back to the home environment where a predominance of injuries occur. The use of highly differing scenarios within the home enables pupils to consider the translation of burn prevention knowledge to different situations. Specific consideration was given to those messages that remain the same, and those that change dependent on what task is being undertaken.

To address these two types of prevention messages were utilised: generic and specific. Generic messages are those repeated in relation to all (or a majority of) situations and form the foundation of basic burn injury prevention. Generic messages tend to be related to

basic safety principles (i.e. Always ask an adult's permission). Whereas, specific messages are those that correspond to the individual scenario. Specific messages tend to be related to a series of steps/actions that can be carried-out to try and reduce risk of injury (i.e. Make sure the hot water bottle is not damaged – check for holes or thin areas). A full list of prevention messages can be found on the burn prevention lesson plan (Appendix 38). Content for other activities in this lesson were:

- devised around setting the scene (Starter Activity – introducing what burns are and why they are important);
- increasing awareness of how long items stay hot for (Hot things around your home – how long it takes for hot items to cool down to a temperature where they would no longer burn a child);
- raising awareness of kitchen appliances that can cause burn injuries (Other risks in the kitchen – asking children to transfer their prevention knowledge to come up with ideas as to how they could avoid and/or reduce risk of injuries from the other appliances);
- a round-up activity (The Three A's – asking children to write down their three most important prevention messages they had learnt during the session – prevention messages are student led with some guidance and examples provided. Messages are checked for appropriateness prior to the students being represented with their Three As in the second lesson).

4.5.3.1.1.2 Burns First Aid Treatment

Learning Objective from the BFAT lesson are as follows -

By the end of the lesson, pupils will be able to:

- Recognise when someone has a burn or scald injury
- Respond appropriately to someone who has a burn to a scald

- Understand when, and who, to call for help

BFAT content follows the evidence-based BBA 'First Aid Position Statement' released in 2014. The guidelines are broken into four main areas: stop the burning process, cool the burn, clothing and jewellery and covering the wound (Table 4, Chapter 1; Appendix 3). These steps consequently make up the 'Cool, Call, Cover' BFAT message which makes up the premise of the BFAT intervention content and main activity of the intervention:

1. **Cool** the burn with running cold tap water for 20 minutes and remove all clothing and jewellery.
2. **Call** for help – 999, 111 or local GP for advice.
3. **Cover** with cling film, non-fluffy dressing or cloth. Make sure the patient is kept warm.

4.5.3.1.1.3 Calling for Help

Information on how and when to call an ambulance were assimilated from guidance provided by the London Ambulance Service (2017). Four points each were identified for how and when to call the emergency services for an ambulance. Directions were assimilated and verified by a member of the emergency services for appropriateness and accuracy. Table 17 reports the directions.

Table 17 - Instructions for how and when to call an ambulance

How to call an ambulance	When to call an ambulance
• You can use any phone to ring the emergency services	• Always call an ambulance if someone is seriously ill or injured, and their life is at risk
• The emergency services number in the UK is 999	• Always tell an adult straight away if you can
• Emergency service phone calls are free of change in the UK, and can be made from any mobile if you have signal and the phone has battery	• If it is not a life-threatening emergency, but the person you are with needs help then: ○ Always tell an adult ○ You could ring NHS 111 ○ Visit or call your GP ○ Make your own way to A&E ○ Talk to your local pharmacist
• The standardised European emergency number is 112. If you call this number in the UK it will also put you through an emergency services operator	• If you are unsure of whether to call an ambulance and there are no adults around to help, then call the emergency services on 999 or 112 and they will be able to help you and give you advice on what is best to do

A similar process was conducted regarding the standardised questions that would be asked upon making a call to emergency services. Guidance was assimilated following information provided by the British Red Cross (2009) and St. John's Ambulance (2015). Six questions were identified as commonly asked alongside six helpful pointers. Directions were assimilated and verified by a member of the emergency services for appropriateness and accuracy. Table 18 reports the questions and helpful points.

Table 18 - The questions that emergency services will ask when making an emergency telephone call and helpful points for answering questions

Questions that the emergency services will ask	Helpful points to consider when talking to the emergency services
1. What service do you need?	• Try to speak clearly
2. What is your name?	• Follow any instructions provided
3. What telephone number are you calling from?	• Answer the questions as best you can
4. Where are you?	• Know your location
5. Can you tell me what happened?	• Stay with the casualty
6. Is the casualty conscious or unconscious?	• Tell the emergency services if there are any dangerous hazards around (such as gas, damage to power-lines or bad weather conditions)

4.5.3.1.2 Teaching Materials

4.5.3.1.2.1 PowerPoint Presentations

The main teaching materials and tools developed for the intervention are two PowerPoint (Microsoft Office, 2016) presentations (one for each lesson) to be used on interactive white boards (IWB) [Appendix 40 & 41]. The PowerPoints provide the main structure for the lessons through presenting information for students to interpret, questions, answers, instructions for activities and exercises and can also bring the classes attention back together. The use of the IWB with PowerPoint enables students to actively engage with the resource by drawing on the board, moving pictures/words around and the embedding of tailor-made videos.

4.5.3.1.2.2 Videos

Video Development

Seven videos showing how long common burn agents take to cool (cup of tea, hair straightener and a hot water bottle) and how-to scenarios (make a hot drink, fill a hot water bottle, take something hot out of the microwave, BFAT) were developed. Videos were embedded within the lesson PowerPoint presentations. Video inception and story boards were developed by the researcher and Dr. Verity Bennett (colleague within the

Children's Burns Research Network), with Carl Rogers providing videography and editing support (Cardiff and Vale University Health Board, Media Resources Centre*).*

Thermal Imaging Videos

Thermal imaging videos presented how long the object/liquid took to cool down to a safe temperature. Table 19 reports safe temperatures deemed appropriate for the filming with reference and explanation for choice of temperature assigned. A FLIR One (FLIR® Systems, Inc., 2017) thermal imaging camera was set-up alongside a DSLR camera to gain the same perspective shot. The item was heated or filled, a calibrated digital thermometer placed upon or within, a digital screen displaying the temperature reading prospectively, and a timer was started (an example can be seen in Figure 13). Filming continued until the thermometer read the safe temperature. All thermal imaging videos were developed with additional support from Mark Thomas of Cardiff and Vale University Health Board Medical Physical department.

Table 19 - Safe Temperatures used within thermal imaging videos by object and justification

Object	Safe temperature	Reasoning for temperature
Hair straighteners	40°C	Prolonged contact at a temperature over this would cause thermal injuries to adults (Civic Plus, 2007)
Cup of tea	38°C.	Temperature advocated for use for infant bathing, akin to body temperature (NHS Choices, 2013)
Hot water bottle	38°C	As above

Three thermal imaging videos were developed:

1. How long does a cup of tea take to cool down?

A time-lapse of how long a cup of tea (made with boiling water from a kettle, with addition of milk) takes to cool down (Figure 13). Cooling time to safe temperature was recorded as 20 minutes.

Figure 13 - Snapshot of 'How long does a cup of tea take to cool down?' video

2. How long do hair straighteners take to cool down?

A time-lapse of how long a pair of straighteners (heated to set temperature as denoted by the changing colour of light, and left on for a further 10 minutes for average duration of use) takes to cool down (Figure 14). Cooling time to safe temperature was recorded as 30 minutes.

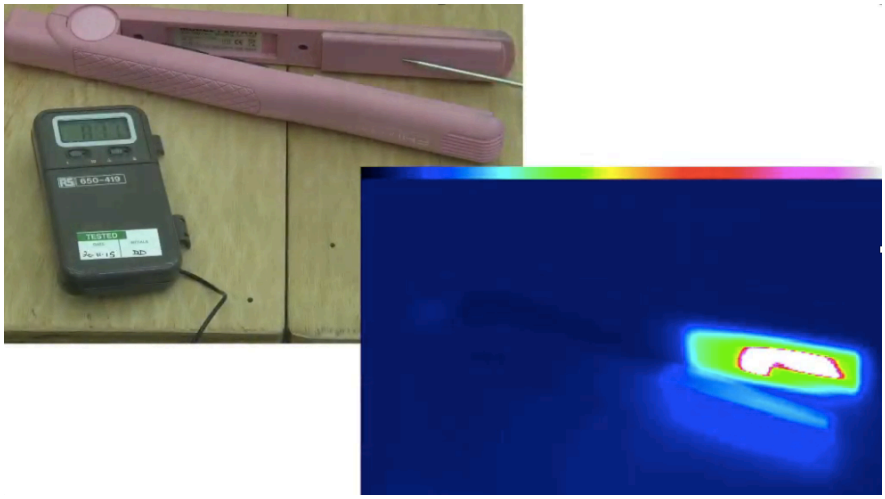


Figure 14 - Snapshot of 'How long do hair straighteners take to cool down?' video

3. How long does a hot water bottle take to cool down?

A time-lapse of how long the water inside a hot water bottle (filled with boiling water from a kettle) takes to cool down. Due to the length of time of cooling, the video was not developed or played within the intervention and was only discussed. This showed the students the duration of time that the hot water stays at a dangerous temperature. To measure the temperature of the encased water the lid was removed in 30-minute intervals and the temperature measured with a calibrated digital thermometer. Cooling time to safe temperature was recorded as 5 hours.

'How to' Videos

A series of three 'how to' videos were developed with children of a similar age to those in receipt of the prospective intervention (peer modelling). 'How to' videos were filmed to provide instruction information for students to reduce the risk of burn injury whilst completing the chosen tasks. Videos were shot in a home environment to increase relatability and transference of new knowledge and skills. Content of the video and scripts were guided by the prevention messages associated with each respectively. Scripted voiceovers were provided by the children within the video respectively.

Four 'How to' videos were created:

1. How to safely make a hot drink

Safe steps advocated for 'how to safely make a hot drink', descriptive asides and questions acting as discussion prompts for students are provided in Table 20. Figure 15 is a snapshot from the video.

Figure 15 - Snapshot of 'How to safely make a hot drink' video

Table 20 - Safety points, descriptive details and student discussion questions for 'How to safely make a hot drink' video

Safety Step	Main Safety Point	Descriptive Detail Provided	Student Discussion Question
1	Get all the equipment ready	Make sure you have everything you need before you start	What might you need?
2	Boil the water	Only use the amount of water that you will need	Why might we do this?
3	Let the kettle stand for a few seconds	Wait until the steam has all disappeared	Why might we do this?
4	Pour the water	Pour the water carefully, slowly, near the cup and away from you. Make sure the cup is on a flat and steady surface	Should we hold the cup?
5	Stir your drink	Stir your drink carefully and slowly	How do you think you should carry a hot drink?

2. How to safely fill up a hot water bottle

Safe steps advocated for ‘how to safely fill up a hot water bottle’, descriptive asides and questions acting as discussion prompts for students are provided in Table 21. Figure 16 is a snapshot from the video.

Figure 16 - Snapshot of 'How to safely fill up a hot water bottle' video

Table 21 - Safety points, descriptive details and student discussion questions for 'How to safely fill a hot water bottle' video

Safety Step	Main Safety Point	Descriptive Detail Provided	Student Discussion Question
1	Check the hot water bottle	Make sure the hot water bottle has no holes and is not damaged in any way	Why is this important?
2	Boil the water	After the kettle has boiled wait for a few seconds to avoid the steam. Only place four cups of water in the kettle	Why do you think we should do this? What size is your hot water bottle?
3	Fill the hot water bottle	Place the empty hot water bottle flat in the sink. Turn the spout up and pour the water slowly and carefully into the hole	What do you think we should do if any water splashes up?
4	Place the stopper in the top	Twist the stopper into place carefully making sure that it is very tight. Always ask an adult to check for you	
5	Place a cover on top	Dry the outside of the bottle and place in a hot water bottle cover. Never place the bottle directly against your skin. Never sleep with a hot water bottle	Why do you think we should never sleep with a hot water bottle? How do you think we can use them?

3. How to safely take something out of the microwave

Safe steps advocated for 'how to safely take something out of the microwave', descriptive asides and questions acting as discussion prompts for students are provided in Table 22.

Figure 17 is a snapshot from the video.

Figure 17 - Snapshot of 'How to safely take something out of the microwave' video

Table 22 - Safety points, descriptive details and student discussion questions for 'How to safely take something out of the microwave' video

Safety Step	Main Safety Point	Descriptive Detail Provided	Student Discussion Question
1	Read the instructions carefully and cook for the required time	Always ask an adult for help if you are unsure	
2	Let the food rest for a few minutes after it has finished cooking	Always leave the food time to cool before opening the microwave door	
3	Use protection for your hands when removing the dish	Always protect your hands if you are going to touch something hot. If opening a lid always be careful to avoid the steam	What could we use to protect our hands?
4	Let the dish cool on the side before trying to move it	Never try to carry a dish that is still warm	Why do you think this is important?

Burns First-aid Treatment Video

A BFAT video was developed parallel to the 'How-to' videos in format and content following the BBA BFAT guidelines (2014) in the format of the 3C's (Cool, Call, Cover) (Appendix 3). Differing from the other videos, this video acted as a 'wrap-up' activity to consolidate all practiced first-aid activities that the children had taken part in throughout the BFAT lesson. An instructional voice-over of correct actions was provided, however no student discussion questions were used alongside this video.

Figure 18 - Snapshot of 'Burns First-Aid Treatment' video

4.5.3.1.3 Take Home Materials

As reported in the results of the systematic review, take home materials are an important component in the transference of newly gained knowledge and skills to the home environment. Additionally, they may act as a tool to create knowledge spread to the direct family and wider community.

Within the UK it is expected that children will receive homework to complete each week, with the amount varying dependent on their age and school (Gov, 2017). Homework exercises commonly include literacy and/or numeracy exercises and topic-related assignments. Exercises are commonly intended to be completed independently by the child with a parent/carer overseeing (information gained from PPI exercises with teachers). Take home materials and exercises are a method of engaging parents/carers with the school. To this end, messages of what children have been learning can be related back to the home and act as a reminder for children, and a way of increasing knowledge spread and engagement to wider home community. It was hoped that take home materials would be developed to engage both children and adult.

Three take home materials were developed:

1. Three A's (Prevention Messages)

An A6 sheet of paper titled 'My Three A's of Prevention' was designed to enable participants to report their own prevention messages (Figure 19). It was prompted that the messages started with 'Always' so as students created their own 'Three A's' to mirror the 'Three C's' of BFAT. Examples of prevention messages were provided by the researcher, though participants were encouraged to make up their own. Following completion, the prevention messages were discussed with the class and later laminated by the researcher and returned to the participants accordingly to take home.

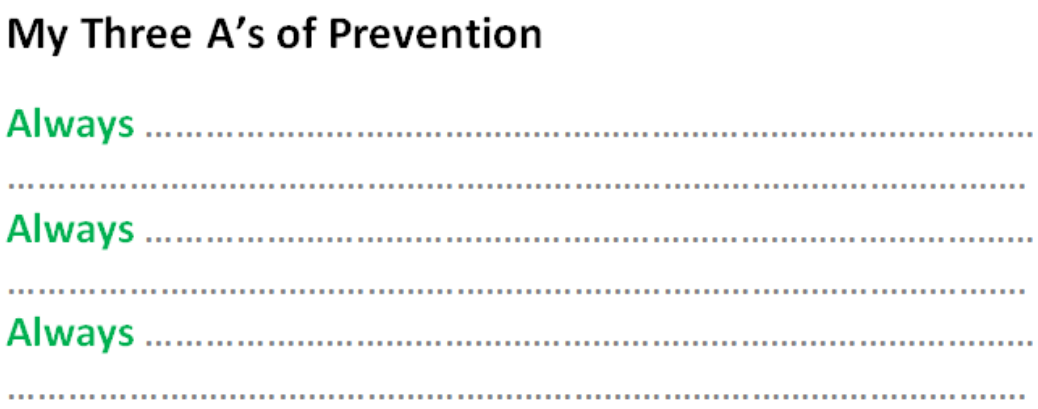


Figure 19 - Image of 'My Three A's of Prevention' student take home material

2. Fridge Magnet

A fridge magnet was designed alongside the wider research team of The Scar Free Children's Burns Research Network based in Cardiff and Bristol in conjunction with A J Graphics. The objective of the fridge magnet was to provide the BBA (2014) BFAT guidelines through pictorial form in a format that would be readily accessible in the home environment. The format of the fridge magnet enables guidelines to be in a prominent place within the home where BFAT, is necessary, would be completed, and where participants (and other members of their household) would regularly look providing reiteration of the guidelines for all.

Figure 20 - Image of Burns First Aid Fridge Magnet student take home material

3. Certificate of Completion

A certificate of completion was designed by the author and awarded to students upon completion of the Learn About Burns intervention (Figure 21). The certificate contains space to be personalised for each participant, three prominent prevention messages from the intervention and the BBA (2014) BFAT guidelines. The certificate acts as a reminder of the prevention and BFAT guidelines, to praise the work of participants and for participants to take ownership of their new knowledge and skills going forward.


CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Congratulations

The Burns Collective

Remember...

Always ask an adult for permission
Always be very careful around hot water and steam
Always ask an adult for help if you do not feel comfortable or confident with what you are doing

.....

You have completed the Learn About Burns program

Signed

.....

Date

.....

Remember...

Cool the burn with cold running tap water for 20 minutes. Remove all clothing and jewellery near the burn

Call for help – tell an adult straight away or ring your GP or 999 for advice

Cover with cling film or a clean, non-fluffy dressing. Make sure the patient is kept warm

Figure 21 - Image of Learn About Burns Completion Certificate student take home material

4.5.3.1.4 Sensitivity

All materials and content were developed with sensitivity in mind. Materials (e.g. videos, presentations and practical sessions) used within the lessons provided discussion points. The messages do not explicitly demonstrate the injury event - instead materials were used in a risk perception format. An example of this is a short video highlighting a boy pouring hot water unsafely – the video was stopped and the children will be asked 'what do you think happened next?', and after quick discussion the second video highlighted the post event of an accident - a red patch of skin indicating a burn. Intervention materials were tested for acceptability during piloting with children and through PPI exercises with parents and steering group members. The intervention content, format and materials were reviewed by both a child psychologist (Mrs Ann Herreboudt) and a health behaviour specialist (Dr. Denitza Williams). Reviewers were asked to provide feedback on age appropriateness and sensitivity.

4.5.3.1.5 Public Awareness

Reported above are a series of active intervention processes designed to have an effect on the individual participant, or group of participants as a whole, receiving the intervention. However, as shown in the intervention Logic Model (Figure 12), the intervention is also designed to increase public awareness of burns through additional passive processes and the dissemination of burn prevention and BFAT knowledge and skill. It is hypothesised that this would occur through:

- Teachers and other members of staff present for intervention delivery increasing their burn prevention and BFAT knowledge
- Schools taking part in the intervention having a heightened awareness of burn prevention and BFAT knowledge
- Students discussing their experience of taking part in the intervention, their knew knowledge and skills with other students, family and friends
- Students taking take home materials to the home environment providing a link to involve parents and spark an interest or discussion in what they had learnt and having materials that provide information of burns prevention and BFAT to all in the home
- Passive dissemination of teachers and parents who had come into contact with the intervention in one of the ways highlighted above discussing it with any extended family, friendships groups or social networks

Previous research on other public health interventions delivered in the school environment to children have reported this positive effect on influencing parents' knowledge, attitude and practice in the home environment though no intervention was delivered actively to them (Evans et al., 2001; Williams et al., 2011; Ishigami et al., 2017).

4.5.4 Item 4 - Who provides

The intervention is delivered by a facilitator who has experience of working with children and is trained in burns prevention and burns first aid.

4.5.4.1 Rationale of who provides intervention

Appropriate delivery of the intervention in accordance with the logic model is essential to the effectiveness of an intervention – especially when considering fidelity (Gearing et al., 2011). When developing any school-based intervention there is a pay-off regarding the long-term sustainability and lower costs of interventions if teachers are trained to deliver the intervention versus higher expenses of having an external provider. Though there is no research in the injury prevention arena on the effectiveness of teacher versus external provider on outcome, evidence from wider school public health interventions has advocated the use of an external providers, especially in high-risk educational settings due to increased implementation quality (Gottfredson and Wilson, 2003; Domitrovich et al., 2008; Cameron et al., 2011). As well as this support from systematic reviews on the effectiveness of school-based first-aid training programs advocate from their conclusions the importance of the facilitator being a trained in delivery as has been shown to impact effectiveness (Reveruzzi et al., 2016).

PPI discussions with teachers also highlighted a lack of confidence in their ability to deliver teaching on public health topics. This is mirrored in academic findings, as although teachers are expected to deliver public health messages and are recognised as important members of the wider public health workforce (Department of Health, 2013), not all UK based teacher training programs are adequately preparing teachers for this role (Dewhirst et al., 2014). During PPI exercises teachers frequently portrayed a lack of knowledge of BFAT and thus expressed concern of their capability to do so even if training was provided. To this

end, it was decided that the facilitator should be someone who had previous experience of working with children, sound knowledge of burn prevention and BFAT.

4.5.5 Item 5 – How

Two lessons delivered face-to-face to Year 4 classes (8 – 9 years old) on consecutive weeks. Classes contain approximately 25 – 30 participants. Lessons are delivered by a trained facilitator supported by either a school teacher or member of school staff. The intervention contains passive and interactive content and practicals guided by the materials. The facilitator aids participant activities, discussions and question and answer activities.

4.5.5.1 Rationale of how the intervention is provided.

Within the UK there are no statutory time allocations for subjects, and schools are free to decide the length of their lessons and the length of lessons often varies between key stages and schools (Parliament. House of Commons, 2016). During PPI exercises teachers reported that a majority of primary schools have lesson lengths of either 45 – 60 minutes; with literacy and numeracy lessons frequently taking place within the morning. The intervention was therefore split into two lessons of approximately 40 minutes in length. This decision was made to fit within schools allocated lesson times.

The intervention takes the format of two school-based lessons (approximately 40 minutes in length) taught on consecutive weeks. The intervention uses a multi-method teaching format providing a high level of interactivity with iterative messaging of key burn prevention and BFAT messages.

A series of short activities were devised including a variety of interactive components to help sustain student attention throughout the two lessons. A general rule advocated by educational professionals working with primary school aged children is that *'a child will pay*

attention for minutes equal to their age' (i.e. a five-year-old will be able to hold their attention on a single activity for five minutes, an eight-year-old will be able to hold their attention on an activity for eight minutes). The interactive components and activities also encourage active learning, rather than the passive provision of facts from the professional delivering the program to the students (Lujan and DiCarlo, 2006). Active learning encourages students to construct their own understanding of the concepts and procedures discussed creating a deeper level of understanding of the content and furthers their ability to translate new knowledge and skills to different environments and events.

High levels of interactivity were also advocated by teachers and parents to increase student enjoyment of tasks throughout PPI exercises. Previous research has emphasised the importance of students developing an interest in the topic and content being taught to inspire and motivate them. Such steps can be advocated by professionals by encouraging discussion, collaborative problem-solving, group work and inquiry-based activities (DiCarlo, 2009).

4.5.5.1.1 Computerisation and use of Media

The integration of computerised and media-based activities was chosen to increase the variety of activities, and to help sustain interest and attention of students. Computerised and media-based activities included the use of the IWB, thermal imaging videos and 'How to' videos. Technological approaches were commended by teachers to sustain student interest and advocated by third parties for increasing novelty and interest in up-take of the programme.

Short food safety videos have previously been shown to promote behaviour change of middle school youth and be feasible for disseminating safety behaviours and acceptable to student participants (Quick et al., 2015). Videos were endorsed for use as a way of breaking-up the lesson and providing a visual link for the key prevention messages from the classroom environment back to the home.

A peer modelling approach was used as a function of model attributes and abilities in the previous 'How to' videos. Modelling refers to behavioural changes that derive from observing others (Berger, 1977). Modelling is an important means of acquiring skills, beliefs, and novel behaviours (Bandura, 1986; Rosenthal and Zimmerman, 1978). In 1970 Bandura postulated in 'Modelling Theory' that modelling may reflect acquisition of new behavioural patterns, also referred to as observational learning.

Within the school environment teachers serve as critically important models in the developing lives of children, but so too do their peers (Schunk, 1987). Theoretically peer modelling depends in part on the perceived similarity between model and observer (Schunk, 1987). *Peer* denotes a child who is roughly equivalent in development to the observer, *model* is an individual whose behaviours, verbalisations, and expressions are attended to by the observer and serve as cues for subsequent modelling.

Schunk and Hanson (1985) showed that peer models can enhance children's self-efficacy for learning cognitive skills better than adults' (especially among low-achieving children) using a before and after trial to measure skill, self-efficacy and persistence. This is an important factor if a child has never completed the act themselves, as children may infer similar competence of those models on the basis of similarity with them, increase their self-efficacy in completing that skill and persistence to do so. Therefore, the use of peer-modelling of children akin to intervention target group was an important factor in the development of the 'How to' videos.

Thermal imaging videos were used to create the visualisation of danger for students. Videos were edited so as the thermal image and standard image were shown side-by-side in one frame with a temperature scale alongside the thermal image. The video format was that of a time-lapse from inception of the heat source until the safe temperature was reached with a timer. The thermal imaging element of the video provides a visualisation of

the heat of the liquid/object with the aim to counteract the common misconception that something is cooler than it is.

4.5.6 Item 6 - Where

The intervention is delivered in a school classroom or appropriate communal room (such as a school hall). Delivery area needs to have access to a computer and ability to show PowerPoint presentations on a big screen with audio. Delivery area needs to have enough space for both whole group and small group exercises.

4.5.6.1 Rationale for where the intervention is delivered

The school setting was chosen as it has been advocated to be an excellent location for the delivery of public health preventative interventions at the scale to derive population-level change (Dewhirst et al. 2014; Denman et al. 2002). Using the school as a setting has a multitude of advantages including:

- Directly reaching the target population;
- Intervention delivery in an environment where the children are habituated, and recognise the space as a place of learning (Ostroff, 2012);
- The ability to replicate delivery every year;
- The ability to reach children across all socio-economic levels.

4.5.6.1 Integration into the school curriculum

To increase ease of integration into the school curriculum and school activities, learning objectives and activities were cross-referenced to the Welsh National curriculum, The National Strategy for Social and Emotional Aspects of Learning – Cymru and The Welsh Network of Health School Schemes (WNHSS). Cross-referencing highlights to the school how the intervention meets pre-specified criteria and goals that they already have to meet for students; such documents can be used as evidence.

4.5.6.1.1 Welsh National Curriculum

The intervention was cross-referenced to the Welsh National Curriculum for Numeracy, Literacy, Mathematics, Science, the Personal and Social Education Framework and the Skills Framework for Key Stage 2. Cross-referencing occurred from the Key Stages 2 – 4 Collection published in June 2015 (Welsh Government, 2015) (Appendix 42).

4.5.6.1.2 The National Strategy for Social and Emotional Aspects of Learning – Cymru

The intervention was cross-referenced to four focus themes (Theme 1 'New Beginnings', Theme 2 'Getting On and Falling Out', Theme 4 'Going for Goals!' and Theme 5 'Good to be me') from the Welsh Strategy for Social and Emotional Aspects of Learning. Cross-referencing occurred from the Primary Guidance Social and Emotional Aspects of Learning Cymru published in September 2010 (Welsh Assembly Government, 2010) (Appendix 42).

4.5.6.1.3 The Welsh Network of Healthy School Schemes

The intervention was cross-referenced to four criteria groups within the WNHSS Safety topic (Leadership and Communication, Curriculum, Ethos and Environment and Family and Community Involvement). Cross-referencing occurred from the indicator document for the WNHSS National Quality Award (Welsh Government, 2014) and personal discussions with Cardiff WNHSS staff (Appendix 42).

4.5.7 Item 7 - When and How Much

The intervention is delivered once to participants. One delivery includes receipt of both lessons on consecutive weeks and receipt of take-home materials. The intervention is delivered late in the summer term (June/July).

4.5.7.1 Rationale for when and how much

The intervention is designed to be delivered once to participants. Delivery occurs prior to the age that evidence suggest an increase in injury prevalence. The intervention makes use of repetition of prevention and first-aid practices providing continual exposure throughout

both sessions through a variety of mediums (e.g. written text on PowerPoint, verbalisations, videos and activities) creating multi-faceted learning for students.

It is vital, where possible for students to receive both lessons. Although there are re-caps of key prevention messages and discussions around these throughout both lessons, if students were to miss either lesson then they would not have received the full intervention appropriately as designed.

The intervention is delivered late in the summer term (June/July). This time-point in the curriculum was chosen as:

- it is after formal assessment periods for schools enabling more time and flexibility in the time-table for intervention delivery
- epidemiological data suggest a higher prevalence of injuries occurring after school or at the weekend and in the summer; therefore, students receive the intervention prior to the time of highest risk when they are most likely to be preparing hot food and drinks on their own over the holiday period

4.5.8 Item 8 – Tailoring

All participants receive the same intervention content and materials. There is no formal tailoring of the intervention prior to or during delivery, however due to the interactive nature of content and materials different topics of discussion could be discussed or brought up by participants.

4.5.8.1 Rationale of tailoring the intervention

All participants receive the same intervention content and materials. No formal tailoring of the intervention occurs prior to, or during intervention delivery. It is however possible that small differences occur during the intervention due the interactive nature of the lessons. Dependent on interactivity of the students receiving the lesson and engagement level of

the facilitator, there may be more discussion, student-led questions, responses and engagement in activities. There is no formal script for the intervention. It is key that the facilitator interacts in an approachable, engaging and open manor to meet the group's needs at the time. The intervention is designed to be student-focused, explorative, active and problem-solving to enable enhanced learning (Biggs, 1999).

The evidence-based nature of the intervention (in regard to age group for delivery, burn agents and mechanisms targeted and BFAT messages) leads to the intervention to be relevant and targeted to the needs of the current school-age population. However, as previously discussed burn agents and mechanisms are always evolving as new products are brought to the market or actions/behaviours come in and out of fashion (chapter 1, section 1.4) therefore tailoring may be appropriate in the future to keep the intervention relevant to the population. BFAT evidence-based best practice guidelines are frequently updated as research progresses so it is key that these are integrated appropriately so students are learning up-to-date best practice.

4.6 Informal feasibility testing

Informal feasibility testing of the intervention was conducted with the 49th Cardiff (1st Rumney) Scout Group. The Scouting Association is a mixed youth organisation that works to help children and young adults to reach their full potential through the development of diverse skills, expressing their creativity and experiencing the wider world (The Scout Association, 2017). The Scout Association is made up of five sections with participants ranging from six to twenty-five years of age (The Scout Association, 2017). The Cub Pack within the local Scout Association is open to males and females, aged 8 – 10.5 years old. The Cub Pack meets weekly on Wednesday evenings from 6:30 – 8:00pm and conduct a series of activities each week towards the development of a new skill. To this end, the Cub Pack group composition, format and content closely reflect the target audience of the

intervention (two school-based lessons for Year 4 students (aged 8 – 9 years old) taught on consecutive weeks).

The Cub Pack was approached through a gatekeeper, Carl Rogers, who is the Scout Group Leader. The researcher attended on two consecutive weeks to deliver both intervention lessons to participants. A verbal feedback exercise was conducted following the completion of both sessions respectively, with participants, Cub Leaders and group volunteers. Feedback from participants assessed participant's enjoyment, engagement and suggestions for improvement. Feedback from Cub leaders and volunteers (a majority were youth leaders aged 14 – 25 years) assessed age-appropriateness, engagement and suggestions for improvement. Feedback was noted, however there was no need for any changes to be fed-back into intervention development – the intervention and logic model stayed the same.

4.7 Chapter Summary

The current chapter has described the Learn About Burns intervention, it's development process and rationale. A logic model of the intervention was presented outlining hypothesised mechanisms of action, possible outcomes and impact, and existing assumptions relating to the effectiveness, fidelity and barriers/facilitators of implementing the intervention and its possible impact. The intervention was developed from an evidence base of a systematic review, an epidemiological study, PPI exercises (with students, parents, teachers, third parties and stakeholders) and educational theory.

Chapter Five: Methods of a Feasibility Study of the Learn About Burns Intervention

5.1 Chapter Introduction

This chapter describes the study methods to assess the feasibility and acceptability of the Learn About Burns intervention described in chapter four. The chapter reports the research questions and study objectives addressed by the following study. Study recruitment, quantitative methods, qualitative methods and ethical approvals and considerations are reported. The MRC guidance (Craig et al., 2008) for developing and evaluating complex interventions report the key elements to assess during a feasibility study to be:

1. Assessing acceptability of the intervention
2. Testing procedures (compliance and delivery)
3. Estimating recruitment and retention

To this end the following questions aim to be answered for the Learn About Burns intervention.

5.2 Research Questions

5.2.1 Primary Question

To assess the feasibility and acceptability of a primary school-based burns prevention intervention for Year 4 pupils (aged seven to nine years old)

5.2.2 Secondary Question

To investigate whether a burns prevention intervention can increase children's KASP on preventing burns and appropriate burns first-aid in year 4 primary school aged children (seven to nine years of age).

5.3 Study Objectives

- To assess the acceptability of the 'Learn About Burns' intervention to students, parents/carers, teaching staff, school SMT, key stakeholders and policy makers;
- Assess and refine the intervention logic model;
- Explore whether the proposed outcome measures are suitable for assessing burns prevention and burns first-aid treatment (BFAT) by assessing levels of completion, floor or ceiling effects and reliability;
- Explore the barriers and facilitators of implementing the intervention;
- To assess recruitment and retention to the intervention;
- Identify the structures, resources and partnerships necessary for a pilot cluster randomized control trial (cRCT) to take place, if warranted.

5.4 Study Design

A before and after feasibility study conducted in Cardiff Local Education Authority (CLEA), Wales, UK between March 2016 and January 2017.

Due to the choice of study design no cost data are to be gathered at this phase. Though it is recognised as important data to gather, especially when considering further evaluation phases to establish the cost of interventions and their corresponding health effects (Noyes and Holloway, 2004), the intervention was considered to be at a too preliminary stage. With the exploratory objectives of the current feasibility study it is expected that the intervention and outcomes are likely to be refined and amended, thus inputs and outcomes cannot be specified with sufficient clarity at this time to aide further health economic analyses (BMJ, 2008). Following refinement, if the further evaluations of the intervention were to occur, it would be expected that cost data to inform a formal health economic analysis would be conducted in pilot and effectiveness trials.

5.5 Recruitment

5.5.1 School Recruitment

Due to the nature of the feasibility study, a sample size calculation was not deemed necessary due to the explorative nature of the work.

Six schools were recruited to the study to conduct feasibility testing. Low socio-economic status (SES) is associated with an increased susceptibility to burns. Prior to recruitment, all eligible primary schools in CLEA were stratified by percentage of students in each school that were eligible for free school meals (FSM). School data were retrieved from the Welsh Government's 'My Local School' database (http://mylocalschool.wales.gov.uk/). Schools were asked to confirm that their FSM status from 'My Local School' was correct upon recruitment. Two schools were recruited from each tertile of FSM: low: ≤ 18.6%, medium:21.5% - 35.8% or high: ≥35.8%).

Recruitment of schools was aided by Cardiff Healthy Schools Scheme (CHSS). Every primary school within the CLEA is a member of the CHSS and has an assigned CHSS school co-ordinator. The CHSS school co-ordinator is a nominated member of school staff who acts as the lead for that school and point of contact for CHSS activities and awards. The researcher was invited to give a brief presentation to introduce the study at the end of the biannual meeting of the CHSS school co-ordinators. The presentation provided a brief outline of the study including the background, inclusion criteria, what would be expected of the school, what would be provided by the study/researcher with a brief time for questions.

Following the presentation schools were invited to take part in the study. An invitation email was sent on behalf of the researcher by CHSS (Appendix 43). Emails were sent directly to CHHS school co-ordinators and head teachers of primary schools that met the inclusion criteria (please refer to inclusion and exclusion criteria below). A school information sheet (Appendix 44) was included in the email detailing all of the appropriate

information for schools to be able to make an informed choice. Upon receipt of the email, schools were asked to reply, expressing either their interest or disinterest in taking part in the study within four weeks. Schools that were interested were contacted to organise a site visit. Two schools from each FSM stratification level were prioritised for recruitment. At site visits the researcher met all appropriate staff (Year 4 teachers, members of the SMT and the head teacher) and discussed the study procedure; what would be expected of the school, what would be expected of the researcher and answered any questions or queries that arose. If the schools agreed, formal recruitment of the school to the study was conducted at the end of the site visit.

5.5.1.1 School Inclusion and Exclusion Criteria

To be eligible schools had to meet the following inclusion criteria:

- Reside within the Cardiff Education Board;
- Have a 'Year 4' class (aged seven to nine), or be able to accommodate the separation of students who were in mixed age classes into one group of seven to nine years old for intervention delivery;
- Be English speaking, or bi-lingual.

And not meet any of the following exclusion criteria:

- Be a Welsh language school;
- Have mixed ages in classes where students age seven to nine years old could not be separated for intervention delivery;
- Be a school dedicated to the support and teaching of students with special educational needs.

Schools that had mixed year groups and could not separate students appropriately were not eligible for the study as the intervention was specifically designed Year 4 students.

Prevention behaviours and scenarios within the intervention were based on those injuries most frequently encountered by Year 4 and those of subsequent years. Another reason for choosing Year 4 was the intervention involves sensitive materials that were inappropriate for those of a younger age. Those schools that teach through the medium of Welsh were excluded due to the lack of Welsh spoken by the researcher – therefore the intervention could not be appropriately delivered within these schools. Those schools that are dedicated to the teaching of pupils with special education needs were not eligible as the intervention was not be appropriate for the pupils and/or teaching environment.

5.5.2 School Consent

Head teachers were asked to consent to participate in the research study on behalf of the school via the Head teacher Consent Form (Appendix 45).

5.6 Quantitative Methodology

Quantitative methods were primarily employed to address the secondary question (to investigate whether a burns prevention intervention can increase children's KASP on preventing burns and providing appropriate burns first-aid in primary school children) and the following objective:

- Explore whether the proposed outcome measures are suitable for assessing burns prevention and BFAT by assessing levels of completion, floor or ceiling effects and reliability.

Data were collected at baseline before intervention delivery (June/July, 2016), immediately after intervention delivery (June/July 2016) and at a six month follow-up (December/January, 2016/2017).

5.6.1 Questionnaire

There are no validated measures of KASP for children's burn prevention and BFAT. The questionnaire was developed by adapting items and scales from previous studies identified in a scoping of the existing literature review to improve burns prevention, burns first-aid and self-efficacy and first-aid (Table 23).

The instrument consisted of four subscales: knowledge, attitude, self-efficacy and practice (KASP). Knowledge, attitude and self-efficacy questions, statements and answers were the same across all three time-points (baseline, post-intervention and six-month follow-up), though question and answer order was altered at each time-point to reduce response bias. Practice questions were different across time-points to gain appropriate and relevant data tailored to each respective time-point. All questions, possible answers and correct answers can be found in Appendix 46. All questions were reviewed for content, age-appropriateness and emotional sensitivity by both a child psychologist (Mrs Ann Herreboudt) and a health behaviour specialist (Dr Denitza Williams).

Table 23 - Adapted items and scales for Learn About Burns intervention feasibility study questionnaire subscales

Questionnaire Subset		Index, Item or Scale	Additional Information
Knowledge	Prevention	Klas et al., (2015)	Prevention questions based on questionnaire items pertaining personal safety, burn prevention and style of question
	First-Aid	British Burns Association (2014) First Aid Position Statement	First-aid questions are based on first-aid position statement (Cool, Call, Cover guidelines)
Attitude		Engeland et al., (2002)	Attitude statements and scale based on items pertaining to 'attitude towards giving first-aid' and 'attitude towards learning first aid'
Self-Efficacy		Engeland et al., (2002)	Self-efficacy statements and scale based on items pertaining to 'self-efficacy'
Practice		N/A	Practice questions were based on the expertise and experience of the research group.

5.6.1.1 Piloting the Questionnaire

The questionnaire was initially piloted with a local Scout-Cub group. The 49th Cardiff (1st Rumney) Scout Group Cubs consisted of 30 children, aged 8 – 10.5 years old, both males and females. The location of the Scout-Cubs group ensured no cross-over with students within the intervention schools – (this was checked upon arrival). The pilot included the delivery of the intervention with baseline and post-intervention testing using the intended questionnaire and data collection procedure. Verbal feedback from all students (n = 30)

and cub leaders (n = 3) was gathered on the intervention and the data collection tool following the session.

5.6.1.2 Knowledge Subscale

The knowledge subscale consisted of 14 multiple choice questions (each with four response options, except for question 14), eight examining prevention and six examining burns first-aid. For each question two distractors were used. Distractor answers were based on public common misconceptions of appropriate BFAT (Davies et al., 2013; Graham et al., 2012; Hsiao et al., 2007). An 'I don't know' option was provided for students to provide participants with an honest outlet to express their lack of knowledge and to not force them to guess one of the other options (used in Klas et al., 2015). Table 24 reports the knowledge subscale and all possible answers provided to students.

Table 24 – Learn About Burns intervention feasibility study knowledge questions and answers for students

	Question Number	Question	A	B	C	D
Prevention	1	**If something is hot and too heavy for me to lift I should**	Wait and ask an adult for help **	Try anyway	Ask a younger brother or sister to help	I don't know
	2	**If I am going to touch something hot I should**	Touch it with the tips of my fingers first to see if it is hot	Use something to protect my hands **	Pick it up with my hands straight away	I don't know
	3	**When making a cup of tea I should**	Get everything I need out of the cupboards first **	Get everything I need out after I have turned the kettle on	It does not matter which order I do things	I don't know
	4	**When filling the kettle I should**	Fill the kettle all the way to the top	Only use the amount of water I need **	Fill the kettle half way	I don't know
	5	**When pouring a hot I liquid I should**	Pour slowly and carefully away from me avoiding the steam **	Pour it very quickly	Pour slowly and carefully with the steam coming towards me	I don't know
	6	**When filling a hot water bottle I should**	Have the hot water bottle lying down in the kitchen side	Have the hot water bottle lying down in the sink **	Hold the hot water bottle upright in front of me	I don't know
	7	**How long does a cup of tea take to cool down** *(To a point where it would not burn a child)*	10 minutes	20 minutes	30 minutes **	I don't know
	8	**Where should liquids and appliances be places**	On a flat and steady surface away from the floor **	On the floor	On a wobbly surface away from the floor	I don't know

First-Aid	9	**What should be used to cool a burn**	Cold running water **	Ice	A wet flannel	I don't know
	10	**How long should you cool a burn**	5 minutes	10 minutes	20 minutes **	I don't know
	11	**What should be used to cover a burn**	A plaster	Clingfilm **	A damp flannel	I don't know
	12	**When should I tell an adult**	Straight away **	Wait until you have finished cooling the burn	Wait until you have covered the burn	I don't know
	13	**Should I put any creams on top of a burn**	Before it has been cooled	After it has been cooled	Never **	I don't know
	14	**Should clothing and jewellery be removed from close to the burn**	Yes**	No	N/A	I don't know

Note: ** indicates correct answer

5.6.1.2.1 Creating the Knowledge Score

Each correct answer was issued with one point. The scores were summated, and a total calculated such that a higher score indicated more knowledge. A knowledge score ranged from 0 - 14 (maximum for prevention was eight and first-aid was six).

5.6.1.3 Attitude Subscale

The attitude subscale consisted of five statements, with the aim of providing a positive-negative evaluation of children's feelings towards an object or action. A five-point Likert Scale was used to assess children's attitudes towards the delivery of first-aid. Following each statement participants could choose how much they agreed with the statement by clicking the number that associated with the answer of their choice. Numbers correlated to

terms on the Likert Scale that ranged from strongly disagree to strongly agree. A smiley face pictorial (shown below, Figure 22) was used to visualise the spectrum for pupils and aide in their understanding. Table 25 reports the attitude subscale statements provided to students.

Figure 22 - Learn About Burns feasibility study attitude subscale face pictorial used for pupils to visualise Likeart scale from strongly disagree to strongly agree

Table 25 – Learn About Burns feasibility study attitude statements for students

Question Number	Statement
1	Giving first-aid is a good thing to do
2	Giving first-aid is unpleasant
3	Giving first-aid is important
4	Giving first-aid can make a difference
5	Anyone can learn first-aid

5.6.1.3.1 Creating an Attitude Score

A numerical value was provided for each point on the Likert Scale ranging from 1 – 5 from strongly disagree to strongly agree. Answers (according to the answer selected on the Likert Scale) were summated for each per participant, such that a higher score indicated a more positive attitude towards the subject of first-aid. Attitude statement two ('first-aid is unpleasant') was reversed for analysis; so as strongly disagree was valued at five points, and strongly agree as one point. An attitude score ranged from 5 - 25.

5.6.1.4 Self-Efficacy Subscale

The self-efficacy subscale consisted of five questions. The aim of this subscale was to assess the student's degree of confidence and assurance in their ability to provide general first-aid

and BFAT. A five-point self-efficacy scale was constructed ranging from 0 – 100, with increments of 25 (Figure 23). An answer of 0 indicates 'cannot do' to 100 indicating 'high certainty can do' (Bandura, 2005). Table 26 reports the self-efficacy subscale statements provided to students.

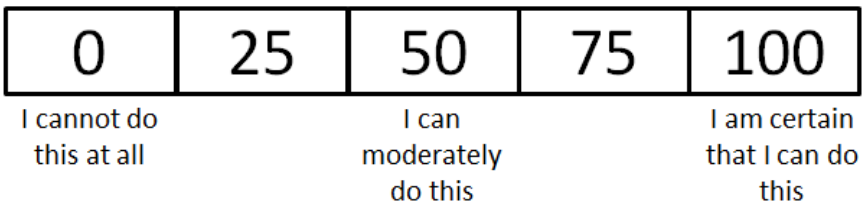


Figure 23 - Learn About Burns intervention feasibility study self-efficacy scale from I cannot do this at all to I am certain that I can do this for students

Table 26 - Learn About Burns feasibility study self-efficacy statements for students

Question Number	Statement
1	I can help someone if they have a burn injury
2	I can call for help if someone has a burn injury
3	I can perform first-aid if someone has a burn injury
4	I can keep myself safe whilst helping someone with a burn injury
5	I can manage some type of first-aid

5.6.1.4.1 Creating a Self-Efficacy Score

A numerical value was provided for each point on the Self-Efficacy scale (0 – 100). Answers (the number selected in on the Self-Efficacy Scale) were summated for each participant, such that a high score indicated more confidence and assurance in the student's ability to complete the task (BFAT). A self-efficacy score ranged from 0 - 500.

5.6.1.4 Practice Sub-Scale

The practice sub-scale pertained to gain self-reported data on the burn, first-aid and safety history of participants. Each question was answered dichotomously (yes or no). Practice questions by time-point can be found in Appendix 46.

5.7 Data Collection Procedure

Data were collected over three time-points:

1. Baseline (June/July, 2016)

   Directly prior to intervention delivery – the start of lesson one

2. Post-Intervention Delivery (June/July 2016)

   Directly post-intervention delivery – the end of lesson two

3. Six Month Follow-Up (December/January, 2016/2017)

   Six months following the post-intervention delivery (no intervention delivery – just data collection)

The questionnaire was presented using Microsoft PowerPoint (Microsoft Office, 2016) with the aid of TurningPoint for PC (Turning Technologies 2013, Microsoft Corporation) and responses provided using Turning Technologies Response Card RF Clickers (Figure 24). Students were asked to 'click' the number that they believed corresponded to the correct answer (knowledge subscale) or the number that they deemed to be most appropriate to them (attitude and self-efficacy subscales). Students were offered 10 seconds to 'lock-in' their answer before the question moved on to the next. Whether all students had answered could be monitored in 'real time' by the researcher using a live feedback system showing the number of responses received versus the number of clickers in use. No additional time was provided for students to answer questions outside of the 10 seconds. No results were reported back to the students and were treated confidentially. Students were informed of this on the Student Information Sheet (Appendix 47) and it was reiterated by the researcher at each data collection point. Any use of the clickers outside of the 10 second response time was not recorded; the clickers were inactive. When active the software records only the first answer provided. Due to this the importance of making a considered and accurate response was reiterated to students. At the beginning of each

data collection, two additional questions were added so that students could practice using the clickers.

Figure 24 - Turning Technologies Response Card RF Clicker

Schools were asked to provide a list of names, ages and genders for all Year 4 students. These lists were used to create participant IDs (a unique numerical identifier) that were used throughout the duration of the project to sustain anonymity. Turning Technologies Response Card RF Clickers also had unique identifiers which could be linked to participant IDs to track individual's responses between baseline, post-intervention delivery and six-month follow-up, as well as supporting anonymity.

5.7.1 Student Consent and Assent

Parents were not asked to provide written consent for their children to take part in this part of the research study. In-line with current standard practice for school-based studies in the UK a 'Parent Opt-Out Letter' (Appendix 48) was provided to inform them of the study four weeks prior to the first lesson. The letter was provided to the school in the format of their choice – physical copies for dissemination or an electronic copy for parent-mail systems. If parents did not wish their child to take part they were asked to return the form

to class teacher to record their dissent. The researcher asked teachers to subsequently inform them of any such instances. An 'opt-out' sustained that the student opted-out of both the intervention and data collection. Due to this, schools were asked to provide alternative provision for those students who did not take part in the study for all three contact points. This was described within the School Information Sheet (Appendix 44).

Students were provided with an information sheet (Appendix 47) four weeks prior to the first lesson. Students were asked to verbally and visually assent (by a show of a thumb up sign) to the study at each contact point.

5.8 Data Management

All files were stored on a server owned by Cardiff University. The server was backed up weekly by Cardiff University Information Services. This server was only accessible to the researcher, or with the researcher's permission. All paper materials were stored in a locked cupboard.

5.9 Data Analysis

Data were extracted from TurningPoint for PC (Turning Technologies 2013, Microsoft Corporation), into a Microsoft Excel workbook (Microsoft Office, 2013) and subsequently uploaded to SPSS (IBM SPSS Statistics 20) for analysis. All syntax and output files were dated and saved, to act as an ongoing record of the data analysis process.

Data were organised by participant ID to sustain anonymity and to be able to combine individual student's data across the data collection time-points.

5.9.1 Data Cleaning

Data cleaning are processes by which errors within datasets can be identified and remedied prior to analysis being run. Due to the nature of the dataset, two processes were put in place to avoid these. Where possible errors were anticipated during the data entry and

uploading process (further details in Section 6.6). A random twenty percent of data were double checked for accuracy following upload by the researcher.

5.9.1.1 Missing Data

Missing data were coded at '9' in the SPSS dataset. Prior to analysis all instances of missing data were checked against both the original excel output file and relevant paper materials. The researcher was careful to distinguish missing data points from student absences which were coded as '8' so as this would not impact the accuracy of the data analysis.

5.9.2 Descriptive Analysis

Descriptive analyses were conducted on sample demographic characteristics (gender and age), knowledge, attitude, self-efficacy and practice answers and scores.

Gender and age characteristics are described using percentages, means and standard deviations. Frequencies and percentages are provided for individual question responses by sub-scale and time-point with 95% confidence intervals of percentages calculated. The distribution of students' knowledge, attitude and self-efficacy scores were summarised using a five-number summary of: means, medians, minimum, maximum, inter-quartiles at each time-point. Practice data are reported with frequencies and percentages of positive responses (where students answered that a practice was conducted). Percentage change in correct answers for knowledge questions, attitude and self-efficacy statements were calculated between baseline and post-intervention delivery and between post-intervention delivery and six month-follow-up.

5.9.3 Statistical Analysis

Statistical analyses were conducted on knowledge, attitude and self-efficacy scores across the three time-points (baseline, post-intervention delivery and six-month follow-up).

Where data were non-normally distributed the equivalent non-parametric alternatives were conducted.

Friedman's tests were conducted to determine if there was a statistically significant change in overall knowledge, attitude and self-efficacy scores across the three time-points (baseline, post-intervention delivery and six-month follow-up). Pairwise comparisons were performed with a Bonferroni correction for multiple comparisons. When appropriate, post-hoc analysis was conducted.

Kruskal-Wallis H tests were conducted to determine if there were differences in overall knowledge, attitude and self-efficacy scores (KAS) according to the three levels of FSM (low, medium and high) at each of the three time-points.

Mann-Whitney U tests were conducted to determine if there were differences in KAS according to gender (male and female) at each of the three time-points. When distributions of scores were similar for both males and females' results are reported with medians, when dissimilar mean ranks are reported.

5.10 Qualitative Methodology

Qualitative methods were primarily employed to address the primary question (to assess the feasibility and acceptability of a primary school-based burns prevention intervention) and the following objectives:

- To assess the acceptability of the 'Learn About Burns' intervention and evaluation intervention to students, parents/carers, teaching staff, SMT, key stakeholders and policy makers;
- Explore barriers and facilitators of implementing the intervention;
- Identify structures, resources and partnerships necessary for a pilot cluster randomized control trial to take place

Interviews and focus groups were conducted with teachers, parents and students to examine the feasibility and acceptability of the intervention and research methods. Topic guides were designed to examine the research questions on the acceptability, demand, implementation, practicality, and potential to be integrated into the curriculum. Data were collected post-intervention delivery (June/July 2016).

5.10.1 Interviews

5.10.1.1 Teacher Interviews

Semi-structured telephone interviews with six teachers, one from each school, were conducted. Interviews were conducted between two- and three-weeks post completion of intervention delivery at each school to reduce recall errors.

5.10.1.1.1 Recruitment

'Criterion-i' purposive sampling (Palinkas et al. 2015) was used to recruit one teacher per school to take part in a semi-structured telephone interview. In criterion-i purposive sampling, those interviewed are required to meet pre-set criteria based on having a lot of experience of the phenomena of interest (Cresswell and Plano Clark 2011). The aim with this sampling method is to get detailed information on experiences with limited resources. The criteria for taking part in the interviews included:

1. Being the lead teacher of a class who received the intervention

   And/or

2. Being present for the delivery of both intervention lessons in the classroom

   And/or

3. Being on the school SMT

These criteria meant that those interviewed had experience of the intervention at all stages from school recruitment to intervention delivery. Teachers were asked to comment on the feasibility and acceptability of all aspects of the intervention (Appendix 49). Teachers were offered a £10 'Love2Shop' voucher at completion of the interview to recompense their time.

5.10.1.2 Parent Interviews

Semi-structured telephone interviews were conducted with six parents across three schools with children who had received the intervention (two from: low, medium and high FSM schools). Interviews were conducted between two and three weeks post completion of intervention delivery to examine the acceptability of the intervention and research methods.

5.10.1.2.1 Recruitment

Convenience sampling (Patton, 1990) was used to recruit six parents from three schools to take part in a semi-structured telephone interview. An equal number of parents from each stratification level were interviewed to enable variations and similarities across groups to be examined (Patton 2002). All parents and guardians whose children received the intervention were invited to take part in a telephone interview. Invitations were disseminated via a parent interview information sheet sent home with the students (Appendix 50). If parents and/or guardians were interested in taking part in an interview they were asked to return the provided slip to the class teacher detailing their name, and preferred method of contact (phone or email) within one week. Responses were collated and returned to the researcher. Individuals were contacted on a first-come-first-serve basis as detailed within the information sheet. Participants were offered a £20 'Love2Shop' voucher at completion of the interview to recompense for their time.

5.10.1.3 Consent

Due to the nature of telephone interviews all participants were asked to verbally consent to the interview before commencement. A standardised dialogue for consent was used (Appendix 51) and read aloud at the beginning of all interviews. Any questions or queries that participants had were answered at this point, and at any point when they may have arisen throughout the interview.

5.10.1.4 Format

All interviews were conducted with the researcher, on a one-to-one basis, in a private room to ensure confidentiality and sensitivity. Telephone calls were made and recorded with a digital audio-recorder

The format of the interview was largely determined by the teacher and parent interview topic guides (Appendix 49 & 52), however relevant and open participant led discussion was encouraged and supported. Simple and direct questions were asked at the beginning of the interview allowing time for the participant to ease into the process and interview. The second part of the interview included a number of open-ended questions providing more flexibility and meeting Wolcott's (1994) pre-sets of qualitative data - watching, asking and examining. Follow-up questions and probes were used to help participants extend or explain interesting points raised. Questions and probes often incorporated terms, phrases and key words used by the participants (Roulston 2010). Emergent issues and themes from earlier interviews were explored in subsequent interviews and focus groups.

5.10.2 Focus Groups

Three student focus groups were conducted with children from three of the schools who received the intervention (one from each stratification level). All focus groups were conducted two weeks post completion of the intervention delivery at each school

respectively to reduce recall errors. Focus groups were used to assess the acceptability, engagement and enjoyment of the intervention.

5.10.2.1 Recruitment, Consent and Assent

All students who received the intervention were invited to take part in the focus groups. Invitations were disseminated via parent and student information sheets sent home with the students, alongside a parent consent form (Appendix 53 & 54). If students were interested in taking part in a focus group they were asked to return the parental consent form to their class teacher within one week. Responses were collated and passed to the researcher who organised an appropriate time for the focus group.

Informed parental consent and student assent were sought. Student assent was viewed as an ongoing process (Cocks, 2006). With this in mind, the researchers placed attention on the assent process and individual verbal and non-verbal actions throughout the focus group (Alderson and Morrow 2004).

5.10.2.2 Format

Focus groups were limited in size to six to eight students to make children feel more comfortable. This is a commonly used group size in a primary school education. Participation was allocated on a first-come-first-served basis. Groups were held during lunchtime within the classroom of the year group and took between 20 – 30 minutes. The format of each focus group was directed by a focus group topic guide (Appendix 55), however relevant and open student led discussion was encouraged and supported. To sustain the interest, focus, attention and reflexivity of the students, the focus groups were split into an introduction and three short activities (Morgan et al. 2002). The short activities were of a playful and interactive style (Hill et al. 1996). A description and explanation of these is provided in Appendix 56. Although parental consent was obtained, students were asked to provide individual written assent for taking part at the beginning of the focus group (Appendix 57).

Emergent issues and themes from the earlier focus groups were explored in subsequent focus groups.

Activities one and two were recorded and transcribed verbatim, and the draw and write exercise (Appendix 55 & 56) was gathered for analysis. Original copies of any work produced by students were scanned by the researcher and subsequently returned to the class teacher who distributed them appropriately. During activity three field notes were taken by the researcher on any relevant conversations the children had during this activity. These were subsequently analysed alongside relevant transcripts.

Draw and Write Exercise students were supplied with a piece of paper (Appendix 58), pens and pencils. Students were asked to think about the question 'If I could help make this program better for other children I would…' and either draw, write or draw and write their responses. Guidance was provided to ensure students stayed on track and 'realistic' with their responses.

5.10.2.3 Use of Focus Groups

The focus groups allowed students to interact and engage with one another exploring their individual and group perceptions and opinions of the intervention in a safe and supported environment. The use of focus groups with children reduces the pressure for every individual to respond to each question or comment (Basch 1987), with support offered by peers allowing participants to be more open with their responses. This approach can reduce the anxiety of speaking in front of others (Vaughn et al. 1996, Morgan et al. 2002). The number and support of students helped to redress the adult-child power imbalance (Mauthner 1997). Hearing others speak can help to jog the memory of others (Hill et al. 1996).

To support students further the researcher and research assistant made a conscious effort to mirror terminology used by participants, to use first names to reduce formality and the

adult-child power imbalance, and established ground rules before commencement of the focus group (Morgan et al. 2002). Ground rules helped students understand what would be expected of them and set boundaries of the focus group (Morgan et al. 2002). Such rules ensured that everyone should have the chance to speak if they would like and that everybody should listen when someone is speaking.

5.10.3 Analysis

Thematic analysis, aided by the framework approach aligned to address the research questions (Gale et al. 2013), was used across all interview and focus group data. A recursive technique to code identification was used with deductive pre-set a priori codes (relating to feasibility and acceptability questions) and an inductive exploration of emerging themes extrapolated from the data.

Thematic analysis was used as it is a search for emerging themes that are important to the description of the phenomenon (Daly et al. 2007). This method of analysis addressed the research questions, whilst allowing the investigation of divergent cases. Comparisons were made between the three participant groups and stratification levels where necessary. Themes were identified in two ways – inductively (data driven) and deductively (analyst driven).

Data were double coded by a researcher trained in qualitative research analysis to assess consistency of codes, categories and theme identification. Validation consisted of multiple coding of 50% of each category of qualitative data. Any discrepancies in identification and analysis were discussed and a consensus reached.

Procedure of analysis followed the framework method for analysis of qualitative data in multi-disciplinary health research (Gale et al. 2013). A detailed description of the steps taken during analysis and interpretation of the data is provided in Appendix 59. Steps taken included:

- Step 1 – Transcription
- Step 2 – Familiarisation
- Step 3 – Coding
- Step 4 – Developing an Analytical Framework
- Step 5 – Applying the Analytical Framework
- Step 6 – Charting data into the Framework Matrix
- Step 7 – Interpreting the Data

The coding framework and definitions for key themes and subthemes can be found in Appendix 60. Table 5 reports the method and population in which the key themes and subthemes were discussed and/or identified.

5.10.3.1 Presentation of results

Results are presented by sub-theme (Table 27). Quotes and images presented in the following section represent examples of the identified themes. Insertions to clarify topic content are denoted by square brackets. The removal of irrelevant information within the quotes is denoted by "…". The removal of personal information or names within the quotes is denoted by "****". The characteristics of each participant are presented in bold parentheses after each quote.

Table 27 - Key themes and subthemes identified during qualitative analysis with the method and population in which they were discussed and/or identified

Key Theme	Subthemes	Method(s)*		Population(s)**		
		Interviews	Focus Groups	Teachers	Parents	Students
Feasibility and Acceptability of the Intervention	Content and Materials	X	X	X	X	X
	Format and Delivery	X	X	X	X	X
	Integration	X		X		
	Reach and Impact	X	X	X	X	X
	Perceived Benefits	X	X	X	X	X
	Empowering Children	X	X	X	X	X
	Engagement and Enjoyment	X	X	X		X
	Suggestions for Improvement	X	X	X		X
Feasibility and Acceptability of the Research Study Methods	Consent Procedures	X		X	X	
	Data Collection Techniques	X	X	X		X
Emergent Themes	Co-learning	X	X	X		X
	Health Promotion, First-Aid and the School Curriculum	X		X	X	
	Childhood Home Experiences	X	X	X		X

	Burn Experiences and Childhood Risk Perception	X			X	
	Public Knowledge and Awareness of Burn Injuries and Burns First-Aid	X		X	X	

5.11 Ethical Approval and Considerations

5.11.1 Ethical Approval

The study was reviewed and given ethical approval by the Cardiff University School of Medicine Research Ethics Committee (SMREC) (SMREC Ref 16/15) (Appendix 61). Discussions with CLEA confirmed that ethical approvals were not deemed necessary by them if SMREC had approved the study. It was the opinion of CLEA that if schools wished to review the documents provided for ethical review on an individual school level then they should be freely be allowed to do so. This option was made available to schools that were recruited to the study, however no schools thought that this was necessary.

5.11.2 Ethical Considerations

5.11.2.1 Withdrawal

All participants were informed before consenting to take part in the research of their right to withdraw from the study at any time. Participants were reminded of this whenever new data were to be collected. If participants wished to withdraw from the study at any time their decision was respected and undisputed. Participant's consent forms were returned to them or disposed of in a suitable manner. Any data or information related to the participant was also disposed of in a suitable manner and was not included in any data analysis.

5.11.2.2 Anonymity

Anonymity and confidentiality of all participants was respected throughout the research. Following consent, and assent if applicable, participants were issued with a unique numerical identifier that was used throughout the duration of the project.

5.11.2.3 Vulnerable Children and Sensitivity - Mitigating Harm

The school and/or teacher were asked before the intervention to provide appropriate information to the research team on any students taking part in the study that may have

difficulty with the intervention. With this knowledge the research team could then address the class as a whole, and/or the student if appropriate individually, with a higher level of sensitivity and introduce the topic at a slower pace or make sure that the additional support is provided. The intervention was open to any students with special educational needs who attended main stream schools. It was asked that those students were provided with the appropriate support or assistance throughout the intervention by the school.

Students were offered a mechanism to feedback immediate concern or worry. All students were issued with a small piece of card, green on one side (symbolising that they are happy to carry on) and red on the other (symbolizing that are not happy to carry on) for both parts of the intervention. Students could choose to turn the card from green to red at any point during the session. This action was addressed immediately with either a change of subject, a slowing down, a higher level of sensitivity or the students could choose to opt-out of the activity.

If any students, parents or teachers of the project raised concerns, worries or asked for further information they were directed towards the following resources for support and guidance:

- The Welsh Dragon Burns Club [Contact information and sources available at: http://www.welshdragonburnsclub.co.uk/en_UK/about-the-club/support-groups]
- The Children's Burns Trust [Contact information and sources available at: http://www.cbtrust.org.uk]
- Dans Fund for Burns [Contact information and sources available at: http://www.dansfundforburns.org]
- The British Burn Association [Contact information and sources available at: http://www.britishburnassociation.org]

5.11.2.4 Safeguarding

All members of the research team had the appropriate Enhanced Disclosure and Barring Service checks for the duration of the project, a copy of each were kept within the site file.

A member of school staff was always present within the classroom or activity space whenever the researcher was working with students.

All members of the research team were aware of how to respond to concerns about a student in order that the student is safeguarded and to follow the schools and Cardiff University's Safeguarding Procedures and Interim Guidelines for Researchers Working with Children, Young People and Vulnerable Adults (designed to be compatible with the All Wales Child Protection Procedures (2008)).

5.12 Chapter Summary

The previous chapter reports the methods used to assess the feasibility and acceptability of the Learn About Burns intervention. The study included the collection of quantitative data and qualitative data from students, teachers and parents from six primary schools in the CLEA from June 2016 – January 2017. Quantitative results from the study are reported and discussed in chapter six and the qualitative results in chapter seven. Both quantitative and qualitative results, and methods used in the study are critiqued and discussed in relation to wider literature in chapter eight (general discussion).

Chapter Six: Quantitative results from the Learn About Burns Feasibility Study

6.1 Chapter Introduction

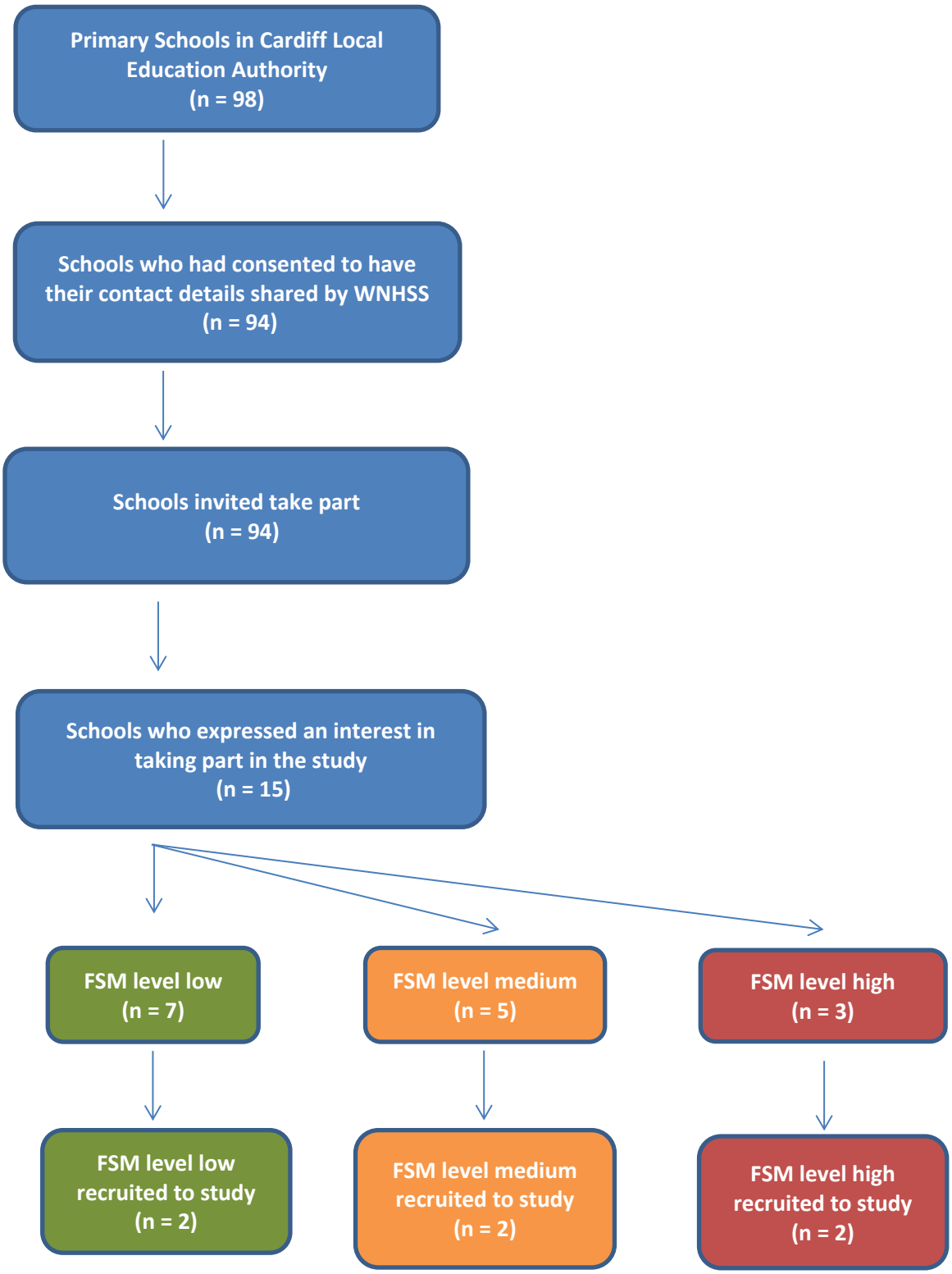
The following chapter reports the quantitative results of the Learn About Burns feasibility study. The objectives of the quantitative components was to explore whether the proposed outcome measures are suitable for assessing burns prevention and BFAT by assessing levels of completion, floor or ceiling effects and reliability.

Next, exploratory analysis into changes in students KASP about burns and BFAT are presented. These analyses also examine whether there are differences in these outcomes according to school-level socioeconomic disadvantage and gender interact. Quantitative results are then discussed.

6.2 Recruitment and Retention

Figure 25 shows that out of the 94 schools invited, 15 (16.0%) expressed an interest in taking part. Six schools were recruited into the study and took part in all three data collections.

All eligible Year 4 students in the recruited schools were invited to take part in the study (n = 319). Three hundred and fifteen students consented to the study (98.7%); three were unable to take part in the study due to additional learning needs, and the parents of one student opted-out.



Note: FSM = free school meal; FSM level = free school meal level assigned prior to recruitment

Figure 25 – CONSORT diagram of the Learn About Burns feasibility study

6.3 School Characteristics

Three hundred and fifteen students across six schools were recruited. Table 27 shows school size ranged from 236 – 532 students, with a mean school size of 390 students. The six schools had a total of 11 classes in Year 4. Year group sizes for Year 4 ranged from 30 – 86 students, with a mean year group size of 53 students. Class sizes ranged from 23 – 33 students, with a mean class size of 29 students.

A majority of schools were classified as being within the Green support category (n = 3) two within the Yellow, and one as Amber of the National School Categorisation System ascribed by the Welsh Government. A mean of 30.4% of students across all schools were eligible for FSM and 27.0% had English as an additional language. As seen within Table 27 no data were available for this variable from School 3. Just over half of students (55.7%) recorded their ethnic background as anything other than "White-British" (later classified as 'Minority Ethnic'). The average school WIMD LSOA ranking is 1388. School 2 is situated within the most deprived decile according to school postcode at rank 1905/1909.

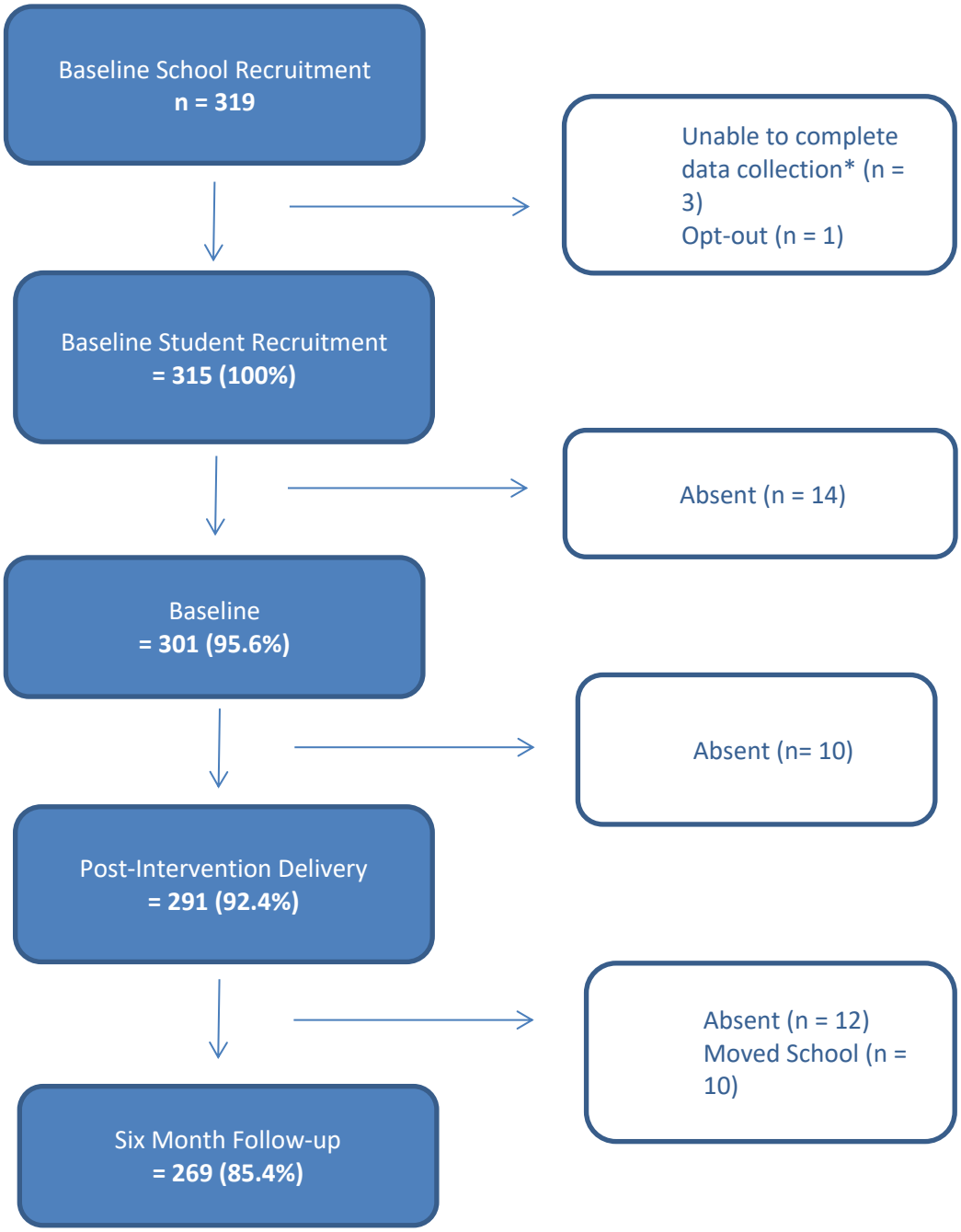
6.4 Population Sample Characteristics

Table 28 reports demographic characteristics of students by school. Of a possible 315 students who consented to take part in the program, 269 participated (85.4%) in both parts of the intervention (lesson one and lesson two) and contributed data at all three time points (baseline, post-intervention delivery and six-month follow-up). Figure 26 demonstrates the flow of students from recruitment to six-month follow-up. At baseline 50.2% were male, 72.9% were 9 years old (mean age =8.72, SD = 0.47). Table 28 reports the demographic characteristics of students by school.

Table 28 - Characteristics of the six participating schools and demographic characteristics of students by school for those who contributing data across all three time-points (n = 269) in the Learn About Burns feasibility study

School Number	Number of Pupils (2016)	FSM Average School (2015)	Assigned FSM Level	Support Category	% EAL School (2015)	Minority Ethnic Pupils School (2016)	WIMD LSOA Rank (higher ranking is more deprived) (2014)	Year 4 Year Group Size	Number of students contributing data†	% male students contributing data †	Age range of students contributing data (years) †	Mean age (years) of students contributing data (Std. Dev) †
1	532	10.1%	Low	Green	20.2%	34.2%	988	63	56	57.1%	8 – 9	8.70 (.464)
2	523	6.8%	Low	Yellow	17.5%	30.1%	1905	86	68	50.0%	8 – 9	8.82 (.384)
3	106	24.5%	Medium	Yellow	*	33.7%	583	35	30	47.7%	7 – 9	8.33 (.606)
4	449	30.0%	Medium	Amber	77.2%	92.9%	197	48	39	51.3%	8 – 9	8.69 (.408)
5	236	61.3%	High	Green	13.1%	44.0%	339	30	26	46.2%	8 – 9	8.81 (.402)
6	496	49.4%	High	Green	7.1%	30.6%	151	57	50	46.0%	8 – 9	8.82 (.388)
Total	2342	30.4%**	Medium**	Green**	27.0%**	44.3%**	1388**	319	269	50.2%**	8 – 9**	8.72 (.466)**

Note: EAL = English an additional language; FSM = Free school meal; WIMD = Welsh index of multiple deprivation; LSOA = lower super output area *Data item is reported as disclosed, not sufficiently robust for publication, not applicable or is otherwise unavailable. Source: My local school Wales ** Average provided where appropriate instead of column total †Number of students contributed to analysis where students provided data at all three time-point



Note: *Students were unable to complete data collection due to additional learning needs

Figure 26 - Flow diagram of student recruitment and participation through the study

6.5 Rates of Completion

Out of the 315 students recruited, 14 (4.4%) did not provide complete data at baseline, 10 (3.2%) post-intervention delivery and 22 (7.0%) at the six-month follow-up.

Across the dataset there were 19 instances of missing data, equating to 0.06% of the entire dataset. Instances of missing data refer to data being missing in one field, for one individual, at one time-point (i.e. a single student did not provide an answer to a single question at one of the three data collection points). Instances were spread across the dataset with three questions having more than one instance of missing data. There were seven instances of missing data at baseline and post-intervention delivery; and five at six-month follow-up. Appendix 63 reports instances of missing data in relation to question number, time-point and number of instances.

6.6 Knowledge, Attitude, Self-efficacy and Practice Statistics

6.6.1 Knowledge

Knowledge results broken up into prevention and first-aid subsets. Tables 29 & 30 show the percentage of correct, incorrect and missing answers for the knowledge sub-scales by time-point. Knowledge results by question, answer and time-point are reported in Appendix 64, Tables 1 - 14.

Table 29 - Number, percentage, 95% confidence interval of percentage of students answering prevention knowledge questions correctly and missing according to data collection by time-point (n = 269)

		Baseline (n = 269)		Post-intervention (n - = 269)		6 month follow-up (n = 269)
	Question	**Correct**	**Missing**	**Correct**	**Missing**	**Correct**
Prevention	**1.** If something is too hot and heavy for me to lift I should	227 (84.4%) (79.5% to 88.2%)	0 - -	261 (97.0%) (94.3% to 98.5%)	0 - -	266 (98.9%) (96.8% to 99.6%)
	2. If I am going to touch something hot I should	227 (84.4%) (79.5% to 88.2%)	0 - -	265 (98.5%) (96.2% to 99.4%)	0 - -	261 (97.0%) (94.3% to 98.5%)
	3. When making a cup of tea I should	125 (46.5%) (40.6% to 52.4%)	0 - -	252 (93.7%) (90.1% to 96.0%)	0 - -	217 (80.7%) (75.5% to 84.9%)
	4. When filling the kettle I should	175 (65.1%) (59.2% to 70.5%)	0 - -	249 (92.6%) (88.8% to 95.1%)	1 (0.4%) -	231 (85.9%) (81.2% to 89.5%)
	5. When pouring a hot liquid I should	199 (74.0%) (68.4% to 78.9%)	0 - -	266 (98.9%) (96.8% to 99.6%)	0 - -	258 (95.9%) (92.8% to 97.7%)
	6. When filling a hot	78 (29.0%) (23.9% to 34.7%)	1 (0.4%) -	238 (88.5%) (84.1% to 91.8%)	0 - -	222 (82.5%) (77.5% to 86.6%)

water bottle I should					
7. How long does a cup of tea take to cold down	16 (5.9%) (3.7% to 9.4%)	0 - -	224 (83.3%) (78.4% to 87.3%)	0 - -	161 (59.9%) (53.9% to 65.5%)
8. Hot liquids should be placed	221 (82.2%) (77.1% to 86.3%)	0 - -	257 (95.5%) (92.4% to 97.4%)	1 (0.4%) -	264 (98.1%) (95.7% to 99.2%)

Table 30 - Number, percentage, 95% confidence interval of students answering first-aid knowledge questions correctly and missing according to data collection by time-point (n = 269)

		Baseline (n = 269)	Post-intervention (n = 269)		6 month follow-up (n = 269)
	Question	**Correct**	**Correct**	**Missing**	**Correct**
First-Aid	**9.** What should be used to cool a burn	104 (38.7%) (33.0% to 44.6%)	261 (97.0%) (94.3% to 98.5%)	0 - -	246 (91.4%) (87.5% to 94.2%)
	10. How long should you cool a burn	86 (32.0%) (26.7% to 37.8%)	261 (97.0%) (94.3% to 98.5%)	0 - -	238 (88.5%) (84.1% to 91.8%)
	11. What should be used to cover a burn	67 (24.9%) (20.1% to 30.4%)	266 (98.9%) (96.8% to 99.6%)	1 (0.4%) -	255 (94.8%) (91.5% to 96.9%)
	12. When should I tell an adult	243 (90.3%) (86.2% to 93.3%)	269 (100.0%) (98.6% to 100.0%)	0 - -	263 (97.8%) (95.2% to 99.0%)
	13. Should I put any creams on top of a burn	86 (32.0%) (26.7% to 37.8%)	216 (80.3%) (75.1% to 84.6%)	0 - -	261 (97.0%) (94.3% to 98.5%)
	14. Should clothing and jewellery be removed if they are close to the burn	194 (72.1%) (66.5% to 77.1%)	266 (98.9%) (96.8% to 99.6%)	0 - -	261 (97.0%) (94.3% to 98.5%)

6.6.1.1 Baseline

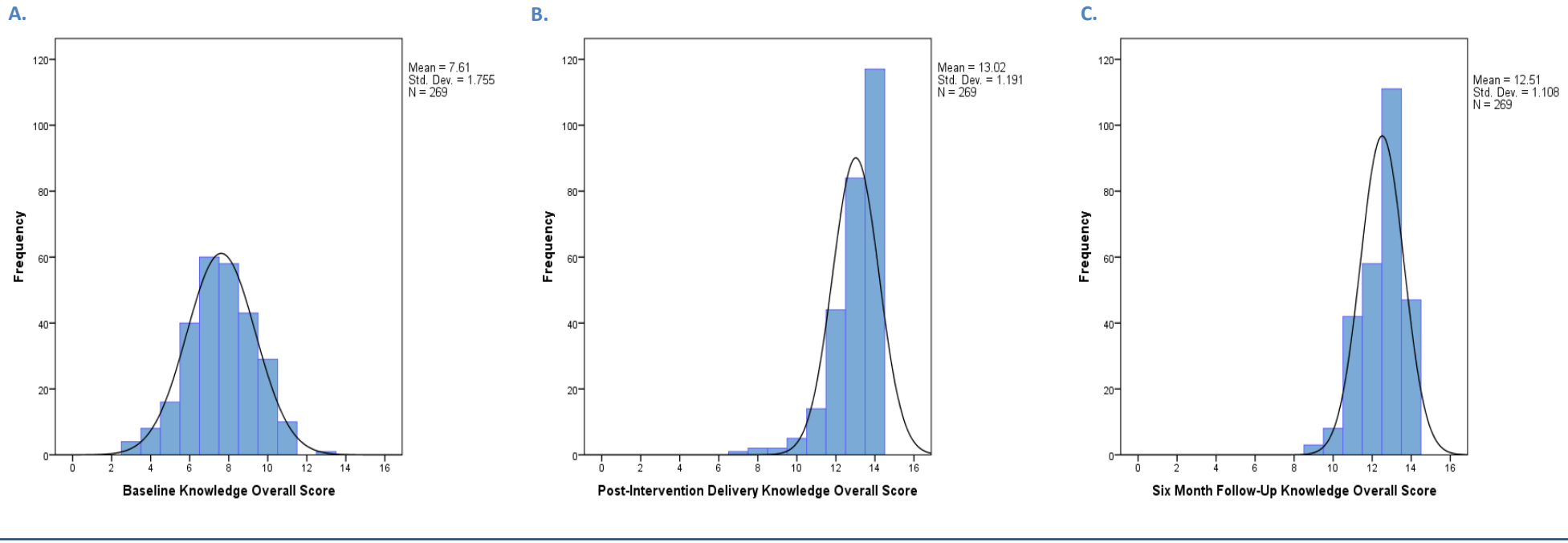
The mean overall knowledge score at baseline for the sample was 7.61 (SD = 1.76). As shown in Table 31 the median = 8.00 (IQR 6.00 – 9.00), range 3.00 – 13.00. A histogram of the distribution of overall knowledge score at baseline is provided in Figure 27.

6.6.1.1.1 Prevention knowledge

The mean score for the prevention knowledge sub-set was 4.71 (SD = 1.28) of possible eight at baseline. At baseline there was great variation in percentage of correct answers provided. Only 5.9% (95% CI 3.7% to 9.4%) students knew it took 30 minutes for a cup of tea to cool down, whereas 84.4% correct answers for questions 1 and 2 (n = 227, 95% CI 79.5% to 88.2%) (Table 29).

Table 31 - Knowledge, attitude and self-efficacy score mean and distributions

		Mean (St. Dev)	Min.	Q1 (25th centile)	Median	Q3(75th centile)	Max.
Knowledge Score (range 0 to 14)	Baseline	7.61 (1.755)	3.00	6.00	8.00	9.00	13.00
	Post-Intervention Delivery	13.02 (1.191)	7.00	12.00	13.00	14.00	14.00
	Six Month Follow-Up	12.51 (1.108)	9.00	12.00	13.00	13.00	14.00
Attitude Score (range 5 to 25)	Baseline	19.97 (3.229)	12.00	18.00	20.00	22.00	25.00
	Post-Intervention Delivery	22.26 (2.710)	8.00	21.00	23.00	24.00	25.00
	Six Month Follow-Up	21.28 (2.000)	15.00	20.00	22.00	23.00	25.00
Self-Efficacy Score (range 0 to 500)	Baseline	358.07 (78.393)	140.00	300.00	360.00	410.00	500.00
	Post-Intervention Delivery	436.80 (69.305)	100.00	420.00	460.00	480.00	500.00
	Six Month Follow-Up	443.64 (28.021)	340.00	420.00	440.00	460.00	500.00



Histogram of overall knowledge score at baseline with normal distribution curve (n = 269)
Histogram of overall knowledge score at post-intervention delivery with normal distribution curve (n = 269)
Histogram of overall knowledge score at six month follow-up with normal distribution curve (n = 269)

Figure 27 - Histograms with normal distribution curve of overall knowledge score at baseline, post-intervention and six-month (n = 269)

6.6.1.1.2 First-Aid knowledge

The mean score for the first-aid knowledge sub-set was 2.90 (SD = 1.15) of possible six at baseline. At baseline there was great variation in percentage of correct answers provided. Only 24.9% (n = 67, 95% CI 20.1% to 30.4%) students knew what should be used to cover a burn, whereas to 90.3% (n = 227, 95% CI 86.2% to 93.3%) knew the correct time to tell an adult (Table 30).

6.6.1.2 Post-Intervention Delivery

The mean overall knowledge score post-intervention was 13.02 (SD = 1.19); an improvement from 7.61 (SD = 1.76) at baseline. As shown in Table 31 the median = 13.00 (IQR 12.00 – 14.00), range 7.00 – 14.00. A histogram of the distribution of overall Knowledge Score at post-intervention delivery is provided in Figure 27.

6.6.1.2.1 Prevention knowledge

The mean score for the prevention knowledge sub-set was 7.43 (SD = 0.82) at post-intervention delivery, a 57.8% increase from baseline. Percentage of correct answers ranged from 83.3% (n = 224, 95% CI 78.4% to 87.3%) for how long it takes for a cup of tea to cool down, to 98.9% (n = 266, 95% CI 96.8% to 99.6%) for safety actions when pouring a hot liquid (Table 28). Question 1 (how to lift something hot and heavy) showed the least percentage change increase in correct answers from baseline (n = 227) to post-intervention delivery (n = 261) at 15.0%. Question 7 (how long it takes for a cup of tea to cool down) showed the largest percentage change increase in correct answers from baseline (n = 16) to post-intervention delivery (n = 224) at 1300.0%.

6.6.1.2.2 First-Aid knowledge

The mean score for the first-aid knowledge sub-set was 5.59 (SD = 0.67) at post-intervention delivery, a large increase of 92.8% from baseline. Percentage of correct answers ranged from 80.3% (n = 216, 95% CI 75.1% to 84.6%) for whether any creams should be applied to a burn wound to 100.0% (n = 269, 95% CI 98.6% to 100.0%) for when

to tell an adult (Table 30). Question 12 (when to tell an adult) showed the least percentage change increase in correct answers from baseline (n = 243) to post-intervention delivery (n = 269) at 10.7%. Question 10 (how long a burn should be cooled) showed the largest percentage change increase in correct answers from baseline (n = 86) to post-intervention delivery (n = 261) at 203.5%.

6.6.1.3 Six Month Follow-Up

The mean overall knowledge score at six-month follow-up was 12.51 (SD = 1.11); a 64.39% improvement from baseline and a decrease of 3.92% from post-intervention delivery. As shown in Table 31 median = 13.00 (IQR 12.00 – 13.00), range 9.00 – 14.00. A histogram of the distribution of overall knowledge score at six-month follow-up is provided in Figure 27.

6.6.1.3.1 Prevention knowledge

The mean score for the prevention sub-set was 6.99 (SD = 0.866) at six-month follow-up; an increase of 48.4% from baseline and a decrease of 5.9% from post-intervention delivery. Percentage of correct answers range from 59.9% (n = 161, 95% CI 53.9% to 65.5%) for how long a cup of tea takes to cool down to 98.9% (n = 266, 95% CI 96.8% to 99.6%) for something that is hot and heavy to lift (Table 29). Question 7 (how long a cup of tea takes to cool down) showed the highest percentage change decrease in correct answers from post-intervention delivery (n = 224) to six-month follow-up (n = 161) at 28.1%. Question 8 (where hot liquids should be placed) showed the largest percentage change increase in correct answers from post-intervention delivery (n = 257) to six-month follow-up (n = 264) at 2.7%.

6.6.1.3.2 First-Aid knowledge

The mean score for the first-aid sub-set was 5.52 (SD = 0.65) at six-month follow-up, an increase of 90.3% from baseline and a decrease of 1.3% from post-intervention delivery. Percentage of correct answers range from 88.5% (n = 238, 95% CI 84.1% to 91.8%) for how to cool a burn to 97.8% (n = 263, 95% CI 95.2% to 99.0%) for when to tell an adult (Table

30). Question 10 (how long to cool a burn) showed the highest percentage change decrease in correct answers from post-intervention delivery (n = 261) to six-month follow-up (n = 238) at 8.8%. Question 13 (whether to apply cream to a burn) showed the largest percentage change increase in correct answers from post-intervention delivery (n = 216) to six-month follow-up (n = 261) at 20.8%.

Overall Knowledge Score

6.6.1.4 Knowledge Score by Time

The distribution of knowledge scores showed a strong negative skew, so Freidman test was used to examine differences in knowledge scores across the three time points. Knowledge scores changed across time points, ($\chi2(2) = 419.795$, $p < .0001$). Post hoc tests showed statistically significant improvements in students' knowledge from baseline to post-intervention from a median score of 8 (IQR = 6, 9) to 13 (IQR = 12, 14) ($p < .0001$), baseline to six month follow-up from a median score of 8.00 (IQR = 6, 9) to 13 (IQR = 12, 13) (p <.0001) and post-intervention to six-month follow-up from a median of 13 (IQR = 12, 14) to 13 (IQR 12, 13) (p <.0001).

6.6.2 Attitude

Table 32 reports attitude results by question, answer and time-point.

6.6.2.1 Baseline

The mean attitude score at baseline for the sample was 19.97 (SD = 3.23) of a possible 25.00 (Table 31). As shown in Table 30 median = 20.00 (IQR 18.00 – 22.00), range 12.00 – 25.00. A histogram of the distribution of attitude scores at baseline shows a negative skew (Figure 28). At baseline the statement that students most agreed with (agree and strongly agree combined) was that 'Giving first-aid is important' at 79.6% (n = 214), that which they most disagreed with (disagree and strongly disagree combined) was that 'Giving first-aid is unpleasant' at 33.1% of students (n = 89).

6.6.2.2 Post-Intervention Delivery

The mean attitude score at post-intervention delivery for the sample was 22.26 (SD = 2.71) (Table 31); a 11.5% improvement from baseline. As shown in Table 32 median = 23.00 (IQR 21.00 – 24.00), range 8.00 – 25.00. A histogram of the distribution of attitude scores at post-intervention delivery shows a negative skew (Figure 28). From baseline to post-intervention delivery data for all statements by student (n = 1345) show an increase in attitude of 33.8% (n = 454/1345), 48.2% stayed the same (n = 648), 17.8% decreased (n = 240) and there was 0.2% missing data (3 instances) (Figure 29).

Table 32 - Number, percentage, 95% confidence interval of students answering attitude questions according to data collection by time-point (n = 269)

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Missing
Giving first-aid is a good thing to do	Baseline	17 (6.3%) (4.0% to 10.0%)	16 (5.9%) (3.7% to 9.4%)	22 (8.2%) (5.5% to 12.1%)	28 (10.4%) (7.3% to 14.6%)	185 (68.7%) (63.0% to 74.0%)	1 (0.4%) -
	Post-Intervention Delivery	11 (4.1%) (2.3% to 7.2%)	5 (1.9%) (0.8% to 4.3%)	18 (6.7%) (4.3% to 10.3%)	45 (16.7%) (12.7% to 21.7%)	190 (70.6%) (64.9% to 75.8%)	0 - -
	Six Month Follow-Up	2 (0.7%) (0.2% to 2.7%)	9 (3.3%) (1.8% to 6.2%)	28 (10.4%) (7.3% to 14.6%)	106 (39.4%) (33.8% to 45.4%)	124 (46.1%) (40.2% to 52.1%)	0 - -
Giving first-aid is unpleasant (reversed)	Baseline	54 (20.1%) (15.7% to 25.3%)	35 (13.0%) (9.5% to 17.6%)	37 (13.8%) (10.1% to 18.4%)	37 (13.8%) (10.1% to 18.4%)	105 (39.0%) (33.4% to 45.0%)	1 (0.4%) -
	Post-Intervention Delivery	11 (4.1%) (2.3% to 7.2%)	10 (3.7%) (2.0% to 6.7%)	39 (14.5%) (10.8% to 19.2%)	47 (17.5%) (13.4% to 22.5%)	162 (60.2%) (54.4% to 65.9%)	0 - -
	Six Month Follow-Up	1 (0.4%) (0.0% to 2.1%)	6 (2.2%) (1.0% to 4.8%)	33 (12.3%) (8.9% to 16.7%)	86 (32.0%) (26.7% to 37.8%)	143 (53.2%) (47.2% to 59.0%)	0 - -
Giving first-aid is important	Baseline	14 (5.2%) (3.1% to 8.5%)	19 (7.1%) (4.6% to 10.8%)	21 (7.8%) (5.1% to 11.6%)	38 (14.1%) (10.5% to 18.8%)	176 (65.4%) (59.6% to 70.9%)	1 (0.4%) -
	Post-Intervention Delivery	6 (2.2%) (1.0% to 4.8%)	8 (3.0%) (1.5% to 5.8%)	13 (4.8%) (2.8% to 8.1%)	39 (14.5%) (10.8% to 19.2%)	203 (75.5%) (70.0% to 80.2%)	0 - -
	Six Month Follow-Up	3 (1.1%) (0.4% to 3.2%)	10 (3.7%) (2.0% to 6.7%)	22 (8.2%) (5.5% to 12.1%)	101 (37.5%) (32.0% to 43.5%)	133 (49.4%) (43.5% to 55.4%)	0 - -

Giving first-aid can make a difference	Baseline	16 (5.9%) (3.7% to 9.4%)	13 (4.8%) (2.8% to 8.1%)	28 (10.4%) (7.3% to 14.6%)	28 (10.4%) (7.3% to 14.6%)	184 (68.4%) (62.6% to 73.7%)	0 - -
	Post-Intervention Delivery	8 (3.0%) (1.5% to 5.8%)	7 (2.6%) (1.3% to 5.3%)	17 (6.3%) (4.0% to 10.0%)	51 (19.0%) (14.7% to 24.1%)	186 (69.1%) (63.4% to 74.4%)	0 - -
	Six Month Follow-Up	6 (2.2%) (1.0% to 4.8%)	16 (5.9%) (3.7% to 9.4%)	28 (10.4%) (7.3% to 14.6%)	104 (38.7%) (33.0% to 44.6%)	115 (42.8%) (37.0 to 48.7%)	0 - -
Anyone can learn first-aid	Baseline	44 (16.4%) (12.4% to 21.3%)	25 (9.3%) (6.4% to 13.4%)	41 (15.2%) (11.4% to 20.0%)	31 (11.5%) (8.2% to 15.9%)	128 (47.6%) (41.7% to 53.5%)	0 - -
	Post-Intervention Delivery	7 (2.6%) (1.3% to 5.3%)	8 (3.0%) (1.5% to 5.8%)	19 (7.1%) (4.6% to 10.8%)	56 (20.8%) (16.4% to 26.1%)	179 (66.5%) (60.7% to 71.9%)	0 - -
	Six Month Follow-Up	5 (1.9%) (0.8% to 4.3%)	13 (4.8%) (2.8% to 8.1%)	28 (10.4%) (7.3% to 14.6%)	97 (36.1%) (30.6% to 42.0)	126 (46.8%) (41.0% to 52.8%)	0 - -

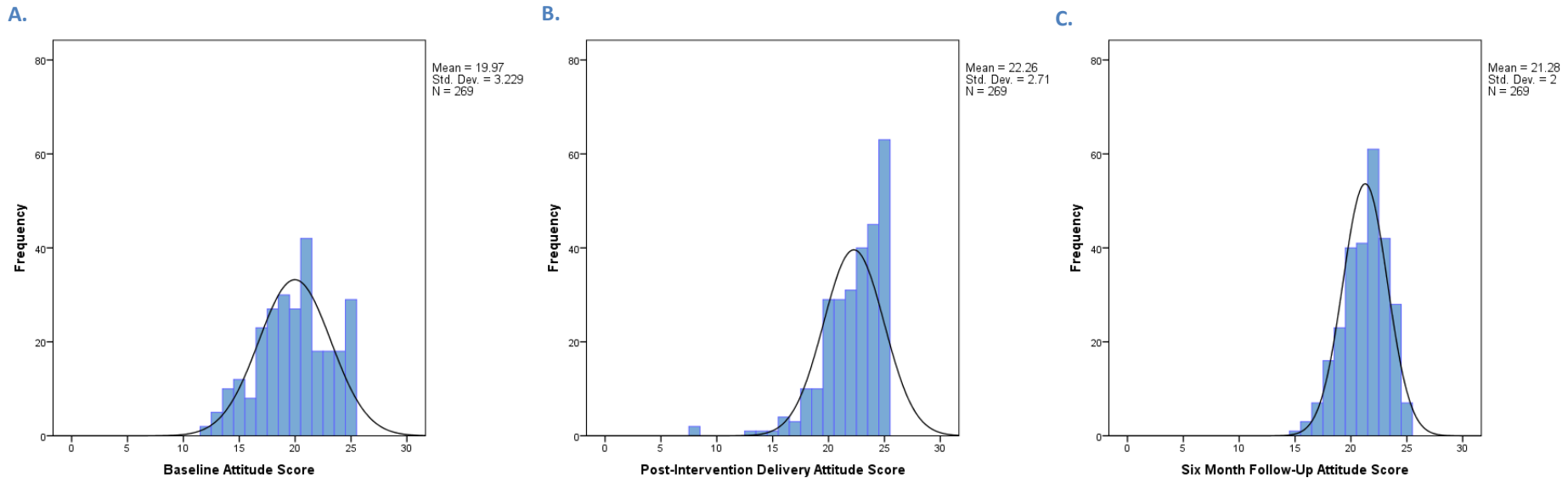


Figure 28

Histogram of attitude score at baseline with normal distribution curve (n = 269)
Histogram of attitude score at post-intervention delivery with normal distribution curve (n = 269)
Histogram of attitude score at six month follow-up with normal distribution curve (n = 269)

Figure 28 - Histograms with normal distribution curve of overall attitude score at baseline, post-intervention and six-month (n = 269)

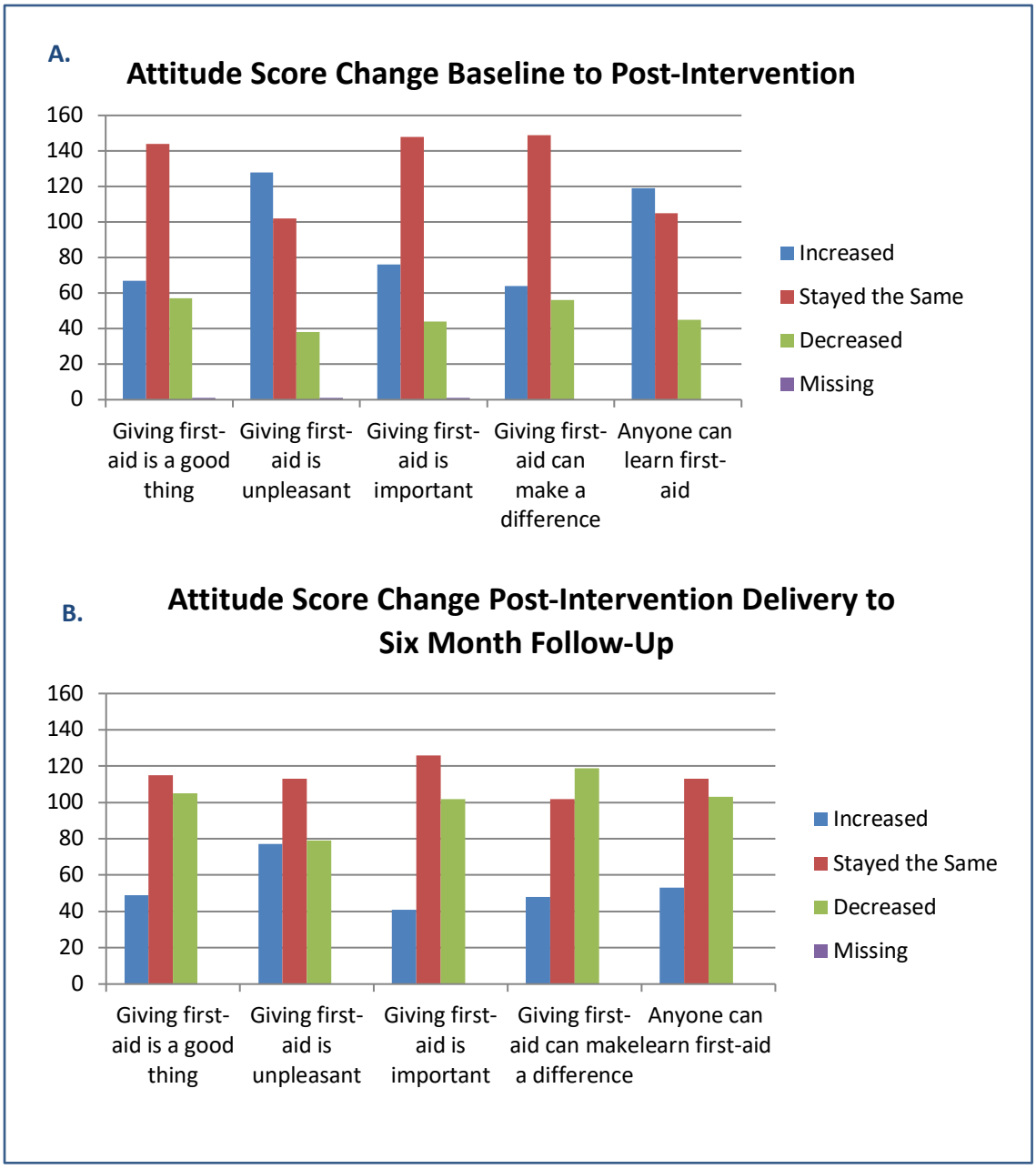


Figure 29

A. Bar chart of attitude score change baseline to post-intervention delivery

B. Bar chart of attitude score change post-intervention delivery to six-month follow-up

Figure 29 - Bar charts of attitude score changes over time by increase, stayed the same, decrease or missing (n = 269)

6.6.2.3 Six Month Follow-Up

The mean attitude score at six-month follow-up for the sample was 21.28 (SD = 2.00) (Table 31); a 6.56% improvement from baseline and a decrease of 4.4% from post-intervention delivery. As shown in Table 31 median = 22.00 (IQR 20.00 – 23.00), range 15.00 – 25.00. A histogram of the distribution of attitude score at six-month follow-up show a negative skew (Figure 28). From post-intervention delivery to six-month follow-up for all statement by students (n = 1345) show a 19.9% increased attitude (n = 268/1345), 42.3% stayed the same (n = 569) and 37.8% decreased (n = 508) (Figure 29).

6.6.2.3 Attitude Score by Time

The distribution of attitude scores showed a strong negative skew, so Friedman test was used to examine differences in attitude scores across the three time points. Attitudes scores changed across time points, ($\chi2(2) = 87.998$, $p < .0001$). Post hoc test showed statistically significant changes in students' attitude from baseline to post-intervention from a median score of 20 (IQR = 18, 22) to 23 (IQR = 21, 24) ($p < .0001$), baseline to six-month follow-up from a median of 20 (IQR = 18, 22) to 22 (IQR = 20, 23) ($p < .0001$) and post-intervention to six-month follow-up from a median of 23 (IQR = 21, 24) to 22 (IQR =20, 23).

6.6.3 Self-Efficacy

Table 33 reports self-efficacy results by question, answer and time-point.

Table 33 - Number, percentage, 95% confidence interval of students answering self-efficacy statements according to data collection by time-point (n = 269)

		0	25	50	75	100
I can help someone if they have a first-aid injury	Baseline	36 (13.4%) (9.8% to 18.0%)	40 (14.9%) (11.1% to 19.6%)	41 (15.2%) (11.4% to 20.0%)	33 (12.3%) (8.9% to 16.7%)	119 (44.2%) (38.4% to 50.2%)
	Post-Intervention Delivery	12 (4.5%) (2.6% to 7.6%)	7 (2.6%) (1.3% to 5.3%)	40 (14.9%) (11.1% to 19.6%)	51 (19.0%) (14.7% to 24.1%)	159 (59.1%) (53.2% to 64.8%)
	Six Month Follow-Up	0 - -	0 - -	15 (5.6%) (3.4% to 9.0%)	123 (45.7%) (39.9% to 51.7%)	131 (48.7%) (42.8% to 54.7%)
I can call for help if someone has a burn injury	Baseline	14 (5.2%) (3.1% to 8.5%)	24 (8.9%) (6.1% to 12.9%)	27 (10.0%) (7.0% to 14.1%)	40 (14.9%) (11.1% to 19.6%)	164 (61.0%) (55.0% to 66.6%)
	Post-Intervention Delivery	11 (4.1%) (2.3% to 7.2%)	9 (3.3%) (1.8% to 6.2%)	23 (8.6%) (5.8% to 12.5%)	40 (14.9%) (11.1% to 19.6%)	186 (69.1%) (63.4% to 74.4%)
	Six Month Follow-Up	0 - -	0 - -	9 (3.3%) (1.8% to 6.2%)	114 (42.4%) (36.6% to 48.4%)	146 (54.3%) (48.3% to 60.1%)
I can perform first-aid if someone has a burn injury	Baseline	77 (28.6%) (23.6% to 34.3%)	37 (13.8%) (10.1% to 18.4%)	41 (15.2%) (11.4% to 20.0%)	30 (11.2%) (7.9% to 15.5%)	84 (31.2%) (26.0% to 37.0%)
	Post-Intervention Delivery	15 (5.6%) (3.4% to 9.0%)	12 (4.5%) (2.6% to 7.6%)	25 (9.3%) (6.4% to 13.4%)	49 (18.2%) (14.1% to 23.3%)	168 (62.5%) (56.5% to 68.0%)
	Six Month Follow-Up	1 (0.4%)	2 (2.0%)	19 (7.1%)	109 (40.5%)	138 (51.3%)

		(0.0 to 2.1%)	(0.2% to 2.6%)	(4.6% to 10.8%)	(34.8% to 46.5%)	(45.4% to 57.2%)
I can keep myself safe whilst helping someone with a burn injury	Baseline	34 (12.6%) (9.2% to 17.1%)	44 (16.4%) (12.4% to 21.2%)	56 (20.8%) (16.4% to 26.1%)	42 (15.6%) (11.8% to 20.4%)	93 (34.6%) (29.2% to 40.4%)
	Post-Intervention Delivery	4 (1.5%) (0.6% to 3.8%)	10 (3.7%) (2.0% to 6.7%)	32 (11.9%) (8.6% to 16.3%)	61 (22.7%) (18.1% to 28.1%)	162 (60.2%) (54.3% to 65.9%)
	Six Month Follow-Up	0	1 (0.4%) (0.0% to 2.1%)	24 (8.9%) (6.1% to 12.9%)	141 (52.4%) (46.5% to 58.3%)	103 (38.3%) (32.7% to 44.2%
I can manage some type of first-aid	Baseline	38 (14.1%) (10.5% to 18.8%)	35 (13.0%) (9.5% to 17.6%)	30 (11.2%) (7.9% to 15.5%)	38 (14.1%) (10.5% to 18.8%)	128 (47.6%) (41.7% to 53.4%)
	Post-Intervention Delivery	5 (1.9%) (0.8% to 4.3%)	4 (1.5%) (0.6% to 3.8%)	18 (6.7%) (4.3% to 10.3%)	59 (21.9%) (17.4% to 27.3%)	183 (68.0%) (62.2% to 73.3%)
	Six Month Follow-Up	0 - -	0 - -	10 (3.7%) (2.0% to 6.7%)	104 (38.7%) (33.0% to 44.6%)	155 (57.6%) (51.7% to 63.4%)

6.6.3.1 Baseline

The mean self-efficacy score at baseline for the sample was 358.07 (SD = 78.39) (Table 31). As shown in Table 31 median = 360.00 (IQR 300.00 – 420.00), range 140.00 – 500.00. A histogram of the distribution of self-efficacy score at baseline shows a slight negative skew (Figure 30). At baseline students reported that they felt most confident in their ability to 'call someone for help if someone has a burn injury' at 61.0% of the sample (n = 164, 95% CI 55.0% to 66.6%) (the selection of '100' on the self-efficacy scale), the action that students reported they felt least confident in their ability to 'perform first-aid if someone has a burn injury' at 28.6% of the sample (n = 77, 95% CI 23.6% to 34.3%) (a selection of '0' on the self-efficacy scale) (Table 33).

6.6.3.2 Post-Intervention Delivery

The mean self-efficacy score at post-intervention delivery for the sample was 436.80 (SD = 69.31) (Table 31); a 21.99% improvement from baseline. As shown in Table 30 median = 460.00 (IQR 420.00 – 480.00), range 100.00 – 500.00. A histogram of the distribution of self-efficacy score at post-intervention delivery shows a strong negative skew (Figure 30). From baseline to post-intervention delivery for all self-efficacy actions (n = 1345 instances) there was a 43.42% increase in self-efficacy (n = 584/1345), 40.07% stayed the same (n = 539) and there was a 16.05% decrease (n = 222) (Figure 31).

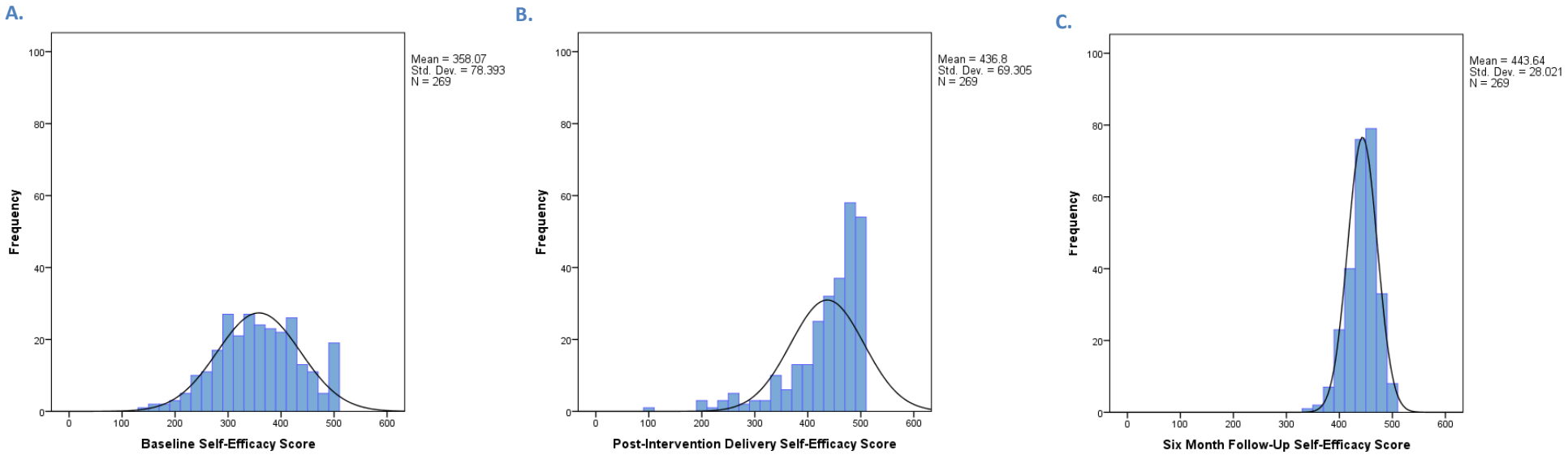
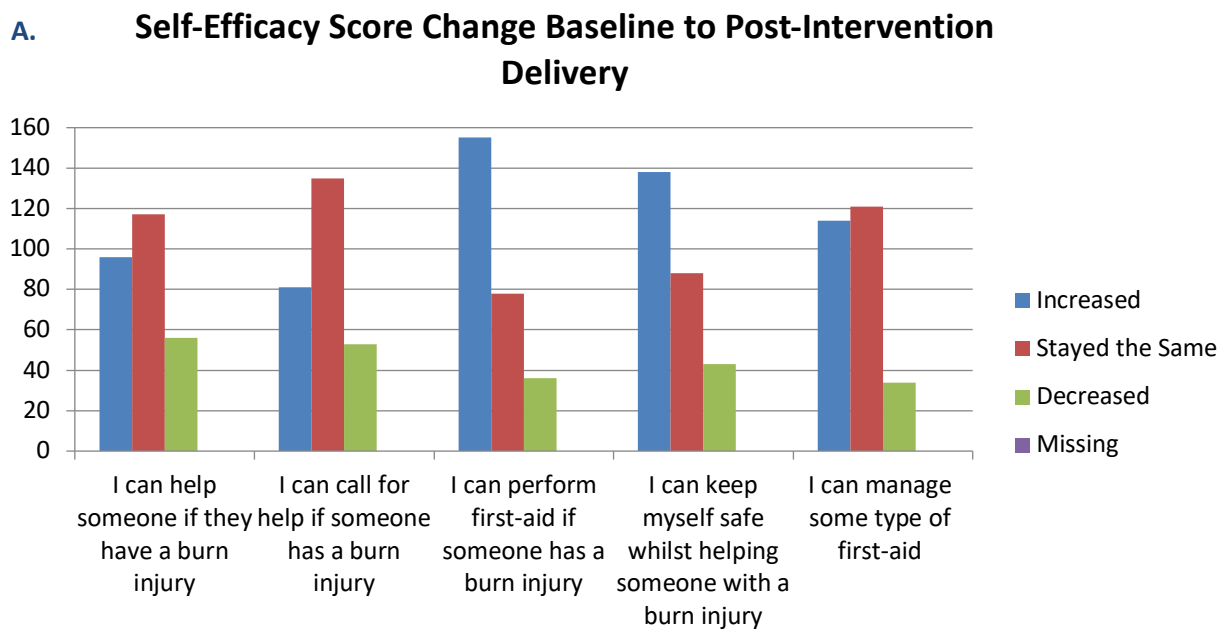


Figure 30

Histogram of self-efficacy score at baseline with normal distribution curve (n = 269)
Histogram of self-efficacy score at post-intervention delivery with normal distribution curve (n = 269)
Histogram of self-efficacy score at six-month follow-up with normal distribution curve (n = 269)

Figure 30 - Histograms with normal distribution curves of self-efficacy score at baseline, post-intervention and six-month follow-up (n = 269)



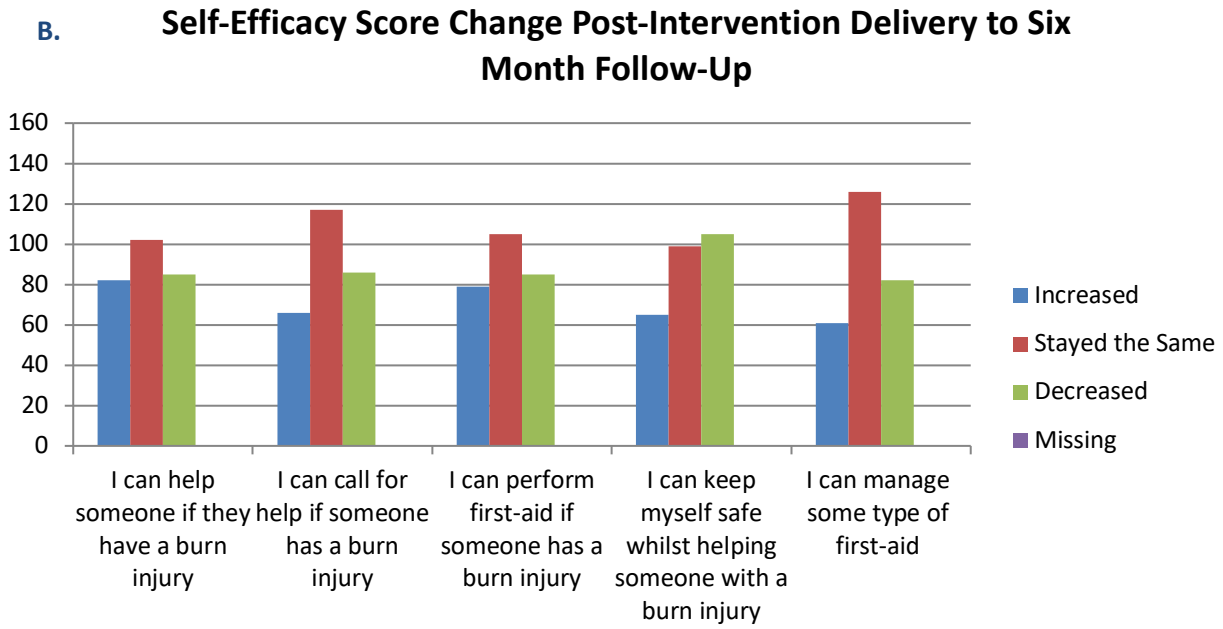


Figure 31

A. Bar chart of self-efficacy score change from baseline to post-intervention delivery

B. Bar chart of self-efficacy score change from post-intervention delivery to six-month follow-up

Figure 31- Bar charts of self-efficacy score changes over time by increase, stayed the same, decrease or missing (n = 269)

6.6.3.3 Six Month Follow-Up

The mean self-efficacy score at post-intervention delivery for the sample was 443.64 (SD = 28.02) (Table 31); a 23.99% improvement from baseline and a 1.57% improvement from post-intervention. As shown in Table 31 median = 440.00 (IQR 420.00 – 460.00), range 340.00 – 500.00. A histogram of the distribution of self-efficacy score at six-month follow-up is provided in Figure 30. From post-intervention delivery to six-month follow-up for all self-efficacy actions (n – 1345 instances) there was a 26.25% increase in self-efficacy (n = 353/1345), 40.82% stayed the same (n = 549) and there was a 32.94% decrease (n = 443) (Figure 31).

6.6.3.4 Self-Efficacy Score by Time

Self-efficacy scores changed across time points, ($\chi2(2) = 170.292$, $p < .0001$). Post-hoc tests showed statistically significant differences changes across students self-efficacy from baseline to post-intervention delivery from a median score of 360 (IQR = 300, 410) to 460 (IQR = 420, 480) ($p < 0.0001$), and from baseline to six-month follow from a median of 360 (IQR = 300, 410) to 440 (IQR = 420, 460) ($p < 0.005$), but not from post-intervention to six month follow-up with a median of 460.00 (IQR = 420, 480) to 440 (IQR = 420, 460) ($p = 0.815$).

6.6.4 Practice

Tables 34 and 35 report practice results by question and time-point.

Table 34 - Number and percentage of self-reported burns and first-aid treatments according to data collection by time-point (n = 269)

	Baseline *	Post-Intervention Delivery **	Six Month Follow-Up ***
Student Self-Report Burn Injury (to themselves)	42 (15.6%)	14 (5.2%)	53 (19.7%)
Student Self-Report Burn Injury (to a member of their family/friends)	55 (20.4%)	18 (6.7%)	36 (13.4%)
Student Self-Report Burn Injury (both to themselves and family/friend)	146 (54.3%)	8 (3.0%)	15 (5.6%)
Of which…			
Received some form of first-aid	169 (69.5%)	26 (65.0%)	61 (58.6%)
First-Aid received in line with BBA Guidelines (2014)	36 (14.8%)	15 (37.5%)	29 (27.9%)
Student helped to deliver the first-aid		17 (42.5%)	51 (49.0%)

*Time period = any time previous to this day

**Time period = two weeks between baseline and post-intervention delivery

***Time period = six months between post-intervention delivery and six-month follow-up

Table 35 - Number and percentage of students who self-reported 'yes' to practice statements by question according to data collection by time-point (n = 269)

	Question	Answered Yes (%)
Baseline*	Had been taught how to make a hot drink safely	132 (49.1%)
	Had been taught how to use an oven safely	106 (39.4%)
	Had previously been taught some sort of first-aid	171 (63.3%)
	Had previously been taught burns specific first-aid	80 (29.7%)
Post-Intervention Delivery**	Students changed the way they act in the kitchen whilst making hot food and drinks	220 (81.8%)
Six Month Follow-Up***	Students had made a hot drink or how food item at home on their own	170 (63.2%)
	Students changed the way they act in the kitchen whilst making hot food and drinks	190 (70.6%)
	Students placed the first-aid magnet on their fridge	192 (71.4%)
	Students spoke to a member of their family or friends about what they had learnt during the intervention	218 (81.0%)
	Reported receiving first-aid teaching from another source	89 (33.1%)

*Time period = any time previous to this day
**Time period = two weeks between baseline and post-intervention delivery
***Time period = six months between post-intervention delivery and six-month follow-up

6.6.4.1 Baseline

6.6.4.1.1 Self-Report Burn Injuries and First-Aid

At baseline 15.6% of students reported that they had previously had a burn injury (n = 42), 20.4% reported a member of their family or friends had previously had a burn (n = 55), and 54.3% reported both (n = 146) (Table 34). Overall this equated to 90.3% of students (n = 243). Of these 69.5% reported that they (or their family/friend) received some form of first-

aid treatment (n = 169). Of all reported burns 14.8% received first-aid in line with the current BBA Guidelines (2014) (n = 36).

6.6.4.1.2 Self-Report Home Safety, Teaching and Practice

At baseline 49.1% of students reported that they had been taught how to make a hot drink safely (n = 132), 39.4% on how to use an oven safely (n = 106) (Table 35). Of all the students 63.3% reported that they had previously been taught some form of first-aid (n = 171), 29.7% that they had been taught burns specific first-aid (n = 80).

6.6.4.2 Post-Intervention Delivery

6.6.4.2.1 Self-Report Burn Injuries and First-Aid

At post-intervention delivery 5.2% of students reported that in the last two weeks (period between baseline and post-intervention delivery) had a burn injury (n = 14), 6.7% reported a member of their family or friends had a burn (n = 18), and 3.0% reported both (n = 8) (Table 33). Overall this equated to 14.9% of students (n = 40). Of these 65.0% reported that they (or their family/friend) received some form of first-aid treatment (n = 26). Of all reported burns 37.5% received first-aid in line with the current BBA Guidelines (2014) (n = 15). In 42.5% of all reported burns students reported that they helped (n = 17).

6.6.4.2.2 Self-Report Home Safety, Teaching and Practice

At post-intervention delivery 81.8% of students self-reported that they had changed the way they acted in the kitchen whilst making hot food and drinks (n = 220) (Table 35).

6.6.4.3 Six Month Follow-Up

6.6.4.3.1 Self-Report Burn Injuries and First-Aid

At six-month follow-up 19.7% of students reported that in the last six months (period between post-intervention delivery and six-month follow-up) had a burn injury (n = 53), 13.4% reported a member of their family or friends had a burn (n = 36) and 5.6% reported

both (n = 15) (Table 34). Overall the equated to 38.7% of students (n = 104). Of these 58.7% reported that they (or their family/friend) received some form of first-aid treatment (n = 61). Of all reported burns 27.9% received first-aid in line with the current BBA Guidelines (2014) (n = 29). In 49.0% of all reported burns students reported that they helped (n = 51).

6.6.4.3.2 Self-Report Home Safety, Teaching and Practice

At six-month follow-up 63.2% of students self-reported that they had made a hot drink or hot food at home on their own (n = 170) (Table 35). One hundred and ninety students (70.6%) reported that they maintained the changes they made to the way they acted in the kitchen whilst making hot food and drinks, a 13.64% decrease from post-intervention delivery. Of all the students 71.4% reported that they placed the first-aid magnet they received as part of the intervention on their fridge (n = 192), and 81.0% reported talking to family or friends about what they had learnt during the intervention (n = 218). From baseline to six-month follow-up 89 students (33.1%) reported receiving first-aid teaching from another source.

6.7 Association of free school meal status and gender on knowledge, attitude and self-efficacy results

6.7.1 Free school meal status

6.7.1.1 Knowledge

6.7.1.1.1 Baseline

Distribution of knowledge scores across all FSM groups (low, n = 124; medium, n = 69 and high, n = 76) at baseline was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 1). A Kruskal-Wallis H test suggested that knowledge scores were the same for the low and medium FSM levels (mean rank = 8.00) and lower for the high FSM level (mean rank = 7.00), but the differences were not statistically different ($\chi^2(2)$ = .489, p = 0.783).

6.7.1.1.2 Post-Intervention Delivery

Distribution of knowledge scores across all FSM groups at post-intervention delivery was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 2). Knowledge scores were the same for the low and medium FSM levels (13.00) and increased for the high FSM level (14.00) but the differences were not statistically significant, $\chi^2(2) = 5.589$, $p = 0.061$.

6.7.1.1.3 Six Month Follow-Up

Distribution of knowledge score across all FSM groups at six-month follow-up was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 3). The mean ranks of knowledge score were statistically significantly different between groups, $\chi^2(2) = 8.934$, $p = 0.011$. Post hoc analysis revealed statistically significant differences in knowledge scores between the medium (mean rank = 122.29) and low (mean rank = 149.63) ($p = 0.043$), and the high (mean rank = 122.67) and low FSM groups, but not between medium and high groups.

6.7.1.2 Attitude

6.7.1.2.1 Baseline

Distributions of attitude scores across all FSM groups (low, n = 124; medium, n = 69 and high, n = 76) at baseline was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 4). Attitude scores were similar for the low (20.00) and high group (20.00), and increased for the medium group (21.00), but the differences were not statistically different, $\chi^2(2) = .825$, $p = 0.662$ (A Kruskal-Wallis H test).

6.7.1.2.2 Post-Intervention Delivery

Distribution of attitude scores across all FSM groups was non-significant at post-intervention delivery as assessed by visual inspection of a boxplot (Appendix 65, Figure 5). Attitude scores increased from low FSM (22.00), to medium (23.00), however stayed the

same for high (23.00), but the differences were not statistically significant, $\chi^2(2) = .825$, $p = .662$.

6.7.1.2.3 Six Month Follow-Up

Distribution of attitude scores across all FSM groups was non-significant at six-month follow-up as assessed by visual inspection of a boxplot (Appendix 65, Figure 6). Attitude scores increased from low (21.50), to medium (22.00), however stayed the same for high (22.00), but the differences were not statistically significant, $\chi^2(2) = .032$, $p = .984$.

6.7.1.3 Self-efficacy

6.7.1.3.1 Baseline

Distribution of self-efficacy scores across all FSM groups (low, n = 124; medium, n = 69 and high, n = 76) at baseline was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 7). The mean ranks of self-efficacy scores were statistically significantly different between groups, $\chi^2(2) = 10.501$, $p = .005$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. A Kruskal Wallis H test post hoc analysis revealed statistically significant differences in Self-Efficacy Score between the high (mean rank = 118.45) and low (mean rank = 151.44) ($p = 0.10$), but not between high and medium (mean rank = 123.69) and medium and low levels.

6.7.1.3.2 Post-Intervention Delivery

Distribution of self-efficacy scores across all FSM groups at post-intervention delivery was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 8). The mean ranks were statistically significantly different between groups, $\chi^2(2) = 21.767$, $p < 0.0001$. Post hoc analysis revealed statistically significant differences in Self-Efficacy Score between the low (mean rank = 112.41) and medium (mean rank = 145.07) ($p = 0.14$), between the low and high (mean rank = 162.72) ($p < .0001$), but not between the medium and high levels.

6.7.1.3.3 Six Month Follow-Up

Distribution of self-efficacy scores across all FSM groups at six-month follow-up was non-significant as assessed by visual inspection of a boxplot (Appendix 65, Figure 9). Self-Efficacy scores increased from low (440.00), to medium (460.00), however decreased to high (440.00), but the difference were not statistically significant, $\chi^2(2) = .147$, $p = 0.929$

6.7.2 Gender

6.7.2.1 Knowledge

6.7.2.1.1 Baseline

Distributions of overall knowledge scores for males (n = 135) and females (n = 134) were not similar at baseline, as assessed by visual inspection (Appendix 65, Figure 10). A Mann-Whitney U test suggest that overall knowledge scores for males (mean rank = 136.44) and females (mean rank = 133.55) were not statistically significantly different, U = 8,851.000, z = -.309, p = 0.758.

6.7.2.1.2 Post-Intervention Delivery

Distributions of overall knowledge scores for males and females were similar at post-intervention delivery, as assessed by visual inspection (Appendix 65, Figure 11). Overall knowledge score was statistically significantly higher in males (*Mdn* = 14.00) than in females (*Mdn* = 13.00), U = 7,598.500, z = -2.413, p = 0.016 at post-intervention delivery.

6.7.2.1.3 Six Month Follow-Up

Distributions of overall knowledge scores for males and females were similar at six-month follow-up, as assessed by visual inspection (Appendix 65, Figure 12). Overall knowledge score was not statistically different between males (*Mdn* = 13.00) was and females (*Mdn* = 13.00), U = 9,895.500, z = 1.397, p = 0.162 at six-month follow-up.

6.7.2.2 Attitude

6.7.2.2.1 Baseline

Distributions of attitude scores for males (n = 135) and females (n = 134) were not similar at baseline, as assessed by visual inspection (Appendix 65, Figure 13). Attitudes scores for males (mean rank – 130.71) and females (mean rank = 139.32) were not statistically different, U = 9623.500, z = -911, p = 0.362 (A Mann-Whitney U test).

6.7.2.2.2 Post-Intervention Delivery

Distributions of attitude scores for males and females were not similar at post-intervention delivery, as assessed by visual inspection (Appendix 65, Figure 14). Attitude scores for males (mean rank = 135.23) and females (mean rank = 134.77) were not statistically different, U = 9,014.500, z = -.048, p = 0.961.

6.7.2.2.3 Six Month Follow-Up

Distributions of attitude scores for males and females were similar at six-month follow-up, as assessed by visual inspection (Appendix 65, Figure 15). Attitude scores were not statistically significantly different between males (*Mdn* = 22.00) and females (*Mdn* = 22.00), U = 9,099.000, z = .086, p = 0.932.

6.7.2.3 Self-efficacy

6.7.2.3.1 Baseline

Distributions of self-efficacy score for males (n = 135) and females (n = 134) were not similar at baseline, as assessed by visual inspection (Appendix 65, Figure 16). A Mann-Whitney U test suggests self-efficacy scores for males (mean rank = 138.48) and females (mean rank = 131.50) were not statistically different, U = 8,575.500, z = -.738, p = 0.460.

6.7.2.3.2 Post-Intervention Delivery

Distributions of self-efficacy score for males and females were not similar at post-intervention delivery, as assessed by visual inspection (Appendix 65, Figure 17). Self-Efficacy Scores for males (mean rank = 130.15) and females (mean rank = 139.88) were not statistically different, U = 9,699.500, z = 1.038, p = 0.299.

6.7.2.3.3 Six Month Follow-Up

Distributions of self-efficacy score for males and females were not similar at six-month follow-up, as assessed by visual inspection (Appendix 65, Figure 18). Self-efficacy scores for males (mean rank = 137.50) and females (mean rank = 132.48) were not statistically different, U = 8,707.500, z = -.544, p = 0.587.

6.8 Discussion

Quantitative results from this study suggest that the school and student recruitment and retention, and data collection procedures are feasible. Although school recruitment rates appear low (98 invitations, 15 expressions of interest, six recruited (two from each FSM level)), over-sampling was employed as this was the first study of this kind and schools were only contacted once via email to express an interest in taking part. From those 15 that expressed an interest, six schools were recruited on a first-come-first-serve basis. Student recruitment rates were high; from all those eligible (n = 319) only one student opted out, and three were removed from the study due to additional learning needs. Student retention was also high with only 10 students leaving the study as they changed schools over the summer holidays. The study outcome measures of knowledge, attitude, self-efficacy and practice as assessed by the 'clicker' questionnaires were based on the proposed outcomes/impact of the logic model. The study showed that it was possible to collect data on all four outcome variable sets, with only 0.06% missing data cross the entire data set suggesting high feasibility of the data collection method. Due to the little detail provided in several previous school-based burn prevention study publications it is hard to compare school and student recruitment rates, though high student retention rates following recruitment are presented even when research is conducted outside of the school environment and using a parental opt-in consent procedure (Chavez et al., 2014). Due to the before and after design all schools knew from the outset that they would receive the intervention. In a future pilot evaluation it would be important to monitor

school recruitment and retention if schools were to be randomised; though promisingly data from other studies show this to have little effect (Kendrick et al., 2007; Morrongiello et al., 2016).

Results suggest an improvement of student's KASP scores from baseline and that these were retained after six months. Knowledge mean scores increased 64.4% from baseline to six-months, attitude 6.6% and self-efficacy 23.9%. Although a smaller increase is noted for attitude, it should be noted that at baseline this score was relatively high at 19.97/25; this could be suggestive of a ceiling effect. Data for knowledge and attitude show a decrease in mean scores from post-intervention to six-month follow-up, which is to be expected, though both remained higher than baseline. However, self-efficacy showed a second rise from post-intervention to six-months (436.80/500 to 44.364); at this stage it would only be appropriate to suggest that this could be down to the natural maturation of students and therefore their increased confidence in performing skills. Self-report practice results also suggest a positive change of increasing safe behaviours with 81.8% of students reporting a change in the way they act in the kitchen whilst making hot food and drinks, though a higher number of burn injuries were reported than expected at 19.7% of students between post-intervention and six-months follow-up.

Increases found in knowledge, attitude and practice mimic those results reported in publications included in the systematic review (e.g. Frederick et al., 2000 and Chavez et al., 2014) though none of the included studies measured all three. The sharp increase in scores from baseline to post-intervention delivery is reassuring though not surprising due to the short time frame involved. Answers, especially for knowledge questions, in this time-frame can be based on short-term recall (Siegler, 2013). However six-month retention results provide more promising evidence of the students learning and processing safety messages and behaviours from the intervention. Although results show a small decrease compared to

post-intervention follow-up (this is to be expected) the increase from baseline students retained information of the key intervention messages.

Caution should be taken when interpreting the practice results due to the use of self-report data. Self-report data can lack validity due to increased chance of recall error unless substantiated to ensure convergent validity (Chan, 2009). Due to the practice data collected (burn incidence and conduction of safety behaviours) convergent sources could include talking to parents/carers or checking primary and secondary healthcare data. Though completing these steps would help to validate student self-report data, it would likely be timely and costly so whether it was necessary in future studies would have to be considered. Other methods of practice data collection could be explored such as assessing student responses to role-play scenarios as demonstrated in the Kendrick et al. (2007) study or the Lamb et al. (S1) (2006) study though these are also time and resource intensive.

Results for practice data should also be interpreted with caution due the higher than expected self-report of burn injuries from baseline to six-month follow-up. Although no direct associations can be made as to the type of burn injury sustained by students (as this was not collected), it may be that some of these burns were sunburn. Although the intervention was not targeting the prevention of sunburn or gathering data on children experiencing sunburn the question did not specifically state to not include sunburn – 'In the last two weeks/six months have you had a burn injury?'. As the intervention was delivered in June/July this would have been peak time for children to sustain sunburn over the summer holidays.

Another consideration to be taken when interpreting self-report burn incidence data is the difference in time-periods included in incidence questions. The question at baseline asks if the participant has ever experienced a burn injury, at follow-up they are asked if they had experienced a burn injury in the last two weeks, and at six-month follow-up they are asked

if they had experienced a burn injury in the last six months. Due to these inconsistences it is hard to compare this data and gain a true understandings of incidence of burn injury in the cohort. It is suggested that in future evaluations this could be changed to ask the same question at each point asking if participants have ever received a burn injury to increase validity of responses and more accurately assess burn incidence.

Data by time-point were tested for interactions by FSM status of the school as a proxy for SES and gender. Data suggest an interaction between retention of knowledge post-intervention and at six-months, such that students in socioeconomically deprived schools retained more knowledge than those in deprived schools; however, there was little evidence for an interaction by gender. It is well established within existing literature that SES is related to academic achievements throughout the life course. A meta-analysis of SES and academic attainment at school conducted by Sirin in 2005 reports SES to have a medium to strong relation, with family SES at student level to have one of the highest correlations of academic performance – at school level correlations are even stronger. Family SES has a direct relationship due to direct provision of resources in the home, and indirect social capital needed to succeed in school (Coleman, 1988); and helps to determine the kind of school and classroom environment that a child has access to (Reynolds and Walberg, 1992). No studies included within the systematic review included SES in analysis of results. One study assessed school achievement as an interaction effect, though no effect was found (Lamb et al. (S1) (2006)). Due to the results of this phase SES is an important factor to carry forward in future evaluations to assess if there is an effect. Although it is not the objective of the feasibility study to assess effectiveness, the relatively large sample size of this feasibility study and positive changes in outcome measures suggests wider piloting is the logical next step.

A number of limitations with the quantitative methods exist. Due to data protection sparse demographic data could be collected from schools at the individual student level. This

meant that FSM level had to be attributed at the school level. Validity of this could be questioned as school level SES does not necessarily equate to student level SES. As well as this FSM entitlement is awarded to students in Wales where the parent or pupils meet a defined set of criteria, and where a request has been made by the parent/carer or on their behalf. Therefore, FSM group level rates are likely to be lower than the actual figure of those eligible as it is only awarded if applied for. This means that some students may not have been classified as being eligible when they were. If FSM attenuated the intervention effect, the effect of the intervention may be overestimated in these pupils.

As well as this none of the student questionnaire components were validated. Validation of instruments of measure ensures that the instruments are measuring what they are supposed to measure, psychometrically sound, efficient and effective (Lai, 2013; Tsang et al., 2017). Due to the diverse outcome measures of previous studies, and growing arena of burns research, to date no validated measures exist. Validation of the instruments were outside the scope of this PhD; however, should be conducted to provide a valid assessment of burns and burn intervention effectiveness. As no validated measures exist the questions and instruments were based on those previously used in other burn injury and first-aid studies.

6.9 Chapter Summary

The quantitative data provide evidence to suggest feasibility of school and student recruitment and retention, data collection procedures and that the intervention has a positive effect on KASP of students. Results suggest an interaction of FSM level and retention suggesting that this should be explored further in future evaluations, alongside the validation of questionnaire components and consideration of how to effectively and accurately record practice of burn safety and burn reduction.

Chapter Seven: Qualitative results from the Learn About Burns Feasibility Study

7.1 Chapter Introduction

This chapter reports the qualitative results and discussion of the Learn About Burns feasibility study. The objectives of the qualitative components were to:

- To assess the acceptability of the 'Learn About Burns' intervention to students, parents/carers, teaching staff and SMT
- Explore barriers and facilitators of implementing the intervention
- Identify structures, resources and partnerships necessary for pilot cluster randomised control trial to take place, if the intervention was acceptable.

7.2 Sample Characteristics

7.2.1 Focus Groups

Three focus groups were conducted (n=19). One focus group was conducted in Year 4 (8 to 9 years of age) for one school in each strata of free school meals (high, medium, low). The average length of focus groups was 20 minutes (range 18 – 22 minutes).

7.2.2 Parent Interviews

Six mothers were interviewed. The average length of interview was 14 minutes (range 12 – 18 minutes).

7.2.3 Teacher Interviews

Six teacher interviews were conducted. One teacher was interviewed from each school. All teachers taught a class who had received the intervention, had been present for the delivery of both intervention sessions, and sat on the school SMT. The majority of the

teachers were female (n=5). The average length of interview was 20 minutes (range 17 – 26 minutes).

7.3 Feasibility and Acceptability of the Intervention

7.3.1 Content and Materials

Students, parents and teachers thought the intervention was acceptable. Overall responses from the students, parents and teachers were positive about the content and materials of the intervention. Teachers noted that the materials were high quality, had a variety of activities and were very interactive. These three qualities enabled their ease of use in the classroom and their ability to engage all children.

All the teachers noted that the content and materials were age appropriate for the students. All expressed that the content was tailored well to the academic abilities of the students, and the sensitivity of the topic. Several teachers noted that tailoring for academic ability can be challenging. The teaching methods and content were acceptable and well suited to the ability within classes.

> "… I find it hard sometimes to cater to all the needs within my class. But I think the program did this very well through the use of different activities and knowledge levels. Those students who were more practical had their chance to shine, so too did the thinkers…" ***Teacher 1***

Parents and teachers noted that "just the right" amount of information and detail were provided. Teachers highlighted the delicate nature when working with children to provide enough detail on aspects to inform, engage and deter students without frightening or upsetting them.

> *"…Yes most definitely because I love the way the videos that were shown stopped just short of the child actually being … it was left to their imagination the children*

were to take it where they wanted rather than actually been shown anything that would put them off, so it was very sensitively handled. So appropriately dealt with their age…" **Teacher 6**

During the focus groups students raised their concerns over two materials. Within two of the focus groups students noted they disliked the picture of a burn shown and a few other students did not like the scream at the beginning of the first aid video. Students disliked the picture because it shocked them and had a "yuk" response that the students felt towards it but students thought knowing what a burn looked like in real life was important so that they could handle the situation effectively.

"… I really didn't like the picture. It look so sore and made me feel very sorry for them… It wasn't very nice…*"* **Focus Group 1, Student 3**

"… No I didn't like it either. But it's good to know what it looks like. Then we will know won't we?...*"* **Focus Group 1, Student 1**

Some students said they disliked the scream at the beginning of the first aid video as it shocked and scared them a little. However, upon reflection students understood why it had been used and the importance of mimicking a real-life scenario.

"…the part that I didn't like was when we saw the video of the first aid. At the beginning there was a scream and that was a bit of a scary…" **Focus Group 3, Student 3**

"… I know why he screamed but it was a bit of a shock…" **Focus Group 3, Student 1**

All thought that the take-home materials (certificate of completion and a magnet) were important. Students suggested that they remember receiving the materials and were excited about being able to take them home and show their families. Many students

suggested that the take home materials provided a talking point for discussion about the prevention of burns and correct first-aid.

> *"… I took it home with me that day and showed my Dad. I talked to him about all the bits on the certificate and magnet..."* ***Focus Group 3, Student 2***

> *"…Yes definitely. I put it straight up and I showed my Mum so she would know what to do too"'* **Focus Group 2, Student 1**

Several teachers suggested the take home materials were important in translating knowledge from the school to the home environment. A few teachers suggested that the provision of the certificate helped to confirm the importance of the intervention and celebrate the students learning. The certificate and magnet helped to empower students and take ownership of their new knowledge and skills.

> *"… a tangible thing of the certificate and their own advice they'd given to themselves about burns, I think that was a really good celebration of the learning that they had done… And they were showing other children. The children were getting that message then to other children who hadn't received the teaching..."* **Teacher 6**

7.3.2 Format and Delivery

The format and delivery of the intervention was acceptable. Students and teachers thought the intervention activities were enjoyable. Key to this was that the intervention had varied materials, short activities and a high level of interactivity. All teachers noted that it was helpful that the intervention covered two 'lessons' within the school time table as it meant the intervention could easily take the place of a lesson without greatly disturbing the timetable.

"… It was really easy to slot into our time table. We did not have to worry about fitting it in around other stud or disturbing the day…" **Teacher 3**

Teachers also praised the separation of the two lessons by a week as it did not take up too much time at once, and allowed time for the children to reflect upon the content. It also meant that students had time to prepare questions for the second session, and that the main messages were repeated. Some teachers suggested that visiting the class twice helped to affirm the importance of the intervention to the students.

"… the fact that you are going back and reflecting on things a week later is really good. I think if you had just done an hour, you might not have had the interest that you did from the children. They could go home and think about what you had done in their homes and see it for themselves. Then they had more questions. They engaged with it more… It also repeats the messages to them. They think it's more important then. You know like 'Wow she's said this a few times, I should probably listen'…" **Teacher 4**

The school and classroom environment was perceived by parents and teachers to be an acceptable environment for intervention delivery.

"… coming from school in a special lesson they tend to learn more. They don't want to listen to their parents constantly going 'Don't do this, don't do that'. So I think some things can be more powerful coming from the school environment… It's as if the school makes it official…" **Parent 1**

"… In school the children are there to learn. It is programmed into them. You've got a captive audience. They are used to learning in the classroom and working together…" **Teacher 4**

"… I think it was good, really good for the children, they weren't afraid to talk about things whereas if you were doing it in a larger group or a different setting… I don't

know if you would have had the same level of… more than anything because they trust each other, they don't mind talking about things that have happened or admitting that they've done things they shouldn't have done. I don't know if you would get that otherwise…" **Teacher 1**

Parents and teachers thought schools were a good place for intervention delivery as:

1. The school is recognised by students as being as a place of formal learning providing an essence of increased importance of the subject and content;
2. Students are used to translating knowledge gained in school to other places and scenarios;
3. Children are used to their classroom and other students within their class. This was expressed to be especially important when introducing a sensitive topic. Familiarity for the students allowed increased engagement with the researcher and each other, enabling more questions to be asked. Alongside classmates' students are used to interacting with teachers and taking part in group activities.

Teachers and parents also discussed the impact of an outsider delivering the intervention. Many teachers commented that they felt that the intervention had a stronger impact as it was provided by a trained individual not known to students, rather than a teacher. Teachers thought an 'outsider' who worked in the field were more influential than teachers when discussing matters of health and personal safety. Teachers though it was important to inspire students and to help to break down pre-existing power perceptions of doctors, hospitals, science, research and healthcare.

"… I would be quite happy delivering it, but then I think it has more impact coming from you. You're there as a representative. You're talking from experience. When a teacher is telling them things, you've taught them everything haven't you? So I don't think we get quite as much impact as you probably gave…" **Teacher 4**

However, an equal number of teachers and parents believed that the intervention would have the same impact if delivered by teachers. Some teachers suggested that with the correct training and provision of materials they would be happy to deliver the intervention but would need training.

> *"… I think if we've got the resources and things, I mean normally when we talk about first aid and things we don't have enough support… so having the resources and materials to hand would make a big difference. I would be more than happy to deliver the program. The most important thing is that they are receiving it. Not always who is delivering it…"* **Teacher 5**

7.3.3 Integration

All teachers stated that they believed that the intervention integrated well within the school curriculum, school ethos and goals.

> *"… It integrated really well. And was obvious how it all related to English, Maths and Science etc… It was obvious that a lot of work has gone in to making it work with the curriculum. That made it easier to engage with as a school. I mean it was easier for us to take part in the study. It didn't really feel like we gave up any curriculum time because the children still learnt so much and it all related to other things they were learning…"* **Teacher 4**

Teachers said their decision to take part was supported by the potential to integrate the intervention within the national curriculum (through considered mapping of the intervention content and activities to the Numeracy, Literacy, Science and PSE curricula). Teachers who worked in schools that taught a topic-based curriculum, thought integrating the intervention into their planning was easy. It was noted by these teachers that variations on the topic of 'the body and healthy eating' were taught in this year group (many within this term) so the intervention linked to the curricula well.

"…because we do context for learning so I am sure there are certain contexts in which we could slip that learning quite easily into an existing context, so find a way to link it in so it wouldn't be a stand-alone it could be quite easily absorbed into our topic of the body and being healthy. We were doing that topic anyway…" **Teacher 2**

A few teachers suggested that it was not necessary that intervention content could be integrated as knowledge on how to prevent burns and burns first-aid was so important.

"… to be honest I don't necessarily think it is that important, catching them at the right age as opposed to directly trying to link it to a topic. I mean it does link well to our topic, but I don't think that's necessarily the most important thing. The most important thing is them actually having the education…" **Teacher 5**

7.3.4 Reach and Impact

Following the intervention many students said that they felt confident to speak to other students about what they had learnt from the intervention. Students suggested that other children were interested in the subject and had a desire to inform and teach others the important messages that they had learnt.

"… Now we can teach people. So that we can teach others and help people if they have a burn…" **Focus Group 1, Student 2**

Students noted the intervention content and had promoted suggest safe practices in the home.

"… my Granny uses a water bottle so yeah I talked to her and told her about it because I know how to do it safely now. She was really listening to me…" **Focus Group 1, Student 6**

Parents also noted that they had been exposed to the intervention messages by providing accounts of how they had conversations with their children about the intervention and

children had changed their behaviour. A few parents discussed how their children were using this time to clarify the information and actions that they had learnt, others noted instead that their children were informing and advising them.

> *"… about 10 years ago I actually got burnt quite badly… when she came home she asked him [interviewee's Father] a lot of questions about what the ambulance did and what happened… she questioned if the ambulance put certain bandages on me and if they put any cling film on me… she was asking him if he put any cold water on the burn and how long for… so she ended up teaching him about why they did that and quizzed him about what she had learnt …"* **Parent 2**

> *"… I have definitely noticed with **** he's more aware about how you can get burnt… he told me how he learnt to do things in the kitchen safely… about the different types of burns and then when I was cooking he noticed that the kettle was on and he said something like 'oh you can get burnt from steam'…"* **Parent 4**

All teachers noted they continued to discuss the content and activities within the class and beyond in their external friendship groups.

> *"…I have actually used it with my own children when we were on holiday when we lit barbecues talking to them about how they should behave if they get a burn…"* **Teacher 5**

> *"… and you know even if it doesn't come from you I will certainly try and bring it up at appropriate points within my curriculum time now next year…"* **Teacher 3**

7.3.5 Perceived Benefits

Students thought the intervention reduced their likelihood of being burned; whereas teachers and parents highlighted the impact of the intervention on student's life skills, personal safety and first-aid.

Students commented that the intervention would help them prevent and treat burn injuries to themselves, peers, family and friends. All students were thankful that they had acquired knowledge on how to prevent and treat burns from the intervention.

> *"… I think it's very very important to learn about burns in school because if we had any equipment or were doing anything where we could hurt ourselves it would hurt and we would have to ask a teacher or ask a friend to run and get the teacher. But now we can help ourselves too before someone else can help us. So that's better. But if we didn't learn about it we wouldn't know what to do..."* **Focus Group 2, Student 3**

> *"… that's why I like learning about it in school. Because now I might be able to stop myself from getting hurt and be able to help if I or someone has a burn…"* **Focus Group 2, Student 1**

> *"…I think it's important to learn about it because now we are safer in school and at home…"* **Focus Group 3, Student 4**

> *"… I think it's very important because… imagine if you were older and you didn't learn about burns ever… and that you wouldn't know what to do. And if you didn't know what to do you wouldn't be able to stay safe and cure your burn and it would hurt very much. But if you did learn about burns, like we did, then you would be safer and if you did get a burn it would get better…"* **Focus Group 2, Student 5**

Teachers and parents reported unintended additional benefits from participating in the intervention of student's level of life skills, personal safety and first aid. These benefits would extend to the wider community of children and society, reducing the amount of burns for this age group, improved risk perception leading to safer environments, raising awareness of the importance of injury prevention and personal safety, improving first-aid skills from a young age, and empathy.

"… I think anything which educates all of us about issues of personal safety can only be a powerful and positive thing…" **Teacher 6**

"… It's something that is not currently covered in the curriculum. We touch on certain elements of hot and cold, and personal safety but not in this way. I think it's an element that is neglected and its something that can so easily happen [a burn injury] at home or when children are out and about. And it's something that can so easily be taught…" **Teacher 3**

"… I guess it's all just about children, and adults, all of us really, working together to help each other. Of course it's important to teach the children about burn prevention and first aid, but I also think first aid is about caring for others and looking after each other. I know they learn about that stuff in school but this gives them it in practice. I hope that they learn and take something from that…" **Parent 3**

7.3.6 Empowering Children

Students thought that burns prevention was important, felt confident that they could keep themselves safe, knew how to correctly treat a burn, and felt empowered by this new knowledge and skills. Students mentioned new insights about how dangerous objects could lead to burn injury events and how they could reduce this risk to conduct themselves in a safer manner.

"… When I look at a cooker now I understand why Mum tells me to be so careful. She always told me before that you had to be careful because it was hot and that that would hurt. But now I know more about it. I get why. And I know what to do. So that helps. Because when I look at it now I know how other children have hurt themselves and now that I don't want that to happen to me. It's sad what happened to them. I know how to stop it from happening to me…" **Focus Group 3, Student 4**

A few parents associated this empowerment with students increased confidence on how to correctly treat a burn injury. Parents suggested these additional knowledge and skills could help students break through the 'helping barrier' to act quickly and appropriately.

> *"… It's a life skill that children need to know, they are empowered obviously then to act in an accident or if they see an accident happen they know to do. I think that is vital…"* **Parent 3**

7.3.7 Engagement and Enjoyment

A key factor associated with acceptability of the intervention for students was enjoyment. All students expressed that they had enjoyed the intervention.

> *"… I really enjoyed the program. I think other children will like it too. It was a lot of fun and something different. It was good to learn about something important but it wasn't boring. I hope lots of children will learn things…"* **Focus Group 3, Student 4**

Several students associated enjoyment with the varied short activities and high level of interactivity. Results from the ranking activity conducted in the focus group replicate this finding. Table 36 shows that in the ranking task interactive and shorter activities scored the highest; with activities conducted individually, and those that included a writing element, scoring the lowest. All Teachers thought that students had enjoyed taking part in the study. A key factor associated with acceptability of the intervention for teachers was that it engaged students. Teachers thought that if students enjoyed the intervention they engaged with it. This enjoyment and engagement with the intervention was perceived by teachers to be the use of the varied activities, materials and high level of interactivity.

Table 36 - Results of student ranking exercise by school with illustrative quotes

School 1 Focus Group 1 (Low FSM)*			School 2 Focus Group 2 (Medium FSM)*			School 3 Focus Group 3 (High FSM)*		
Ranking Position	Activity	Illustrative Quote	Ranking Position	Activity	Illustrative Quote	Ranking Position	Activity	Illustrative Quote
1	**First-Aid Practical**	*'…It was fun because me and **** kept messing it up and then we had to start all over again. And then we got it perfect. And then it was really good. And we got to do that together…'* **Student 1**	1	**First-Aid Practical**	*'…It was so much fun working together and practicing our burns. I liked how we got to be involved and do stuff together…'* **Student 5**	1	**First-Aid Practical**	*'…It was fun to put it around each other's arms. It looked like you actually had a burn…'* **Student 4**
2	**Group Work**	*'…I liked the group work because you get to listen to other people ideas…'* **Student 2**	2	**Group Work**	*'…Because we can all work together and we get different ideas. And when we get different ideas we get lots of ideas and learn more about the burns…'* **Student 3**	2	**Group Work**	*'…This is about the group work. All of this that we have done has made us work together really well and to help each other. So I think that is very fun and interesting for us…'* **Student 6**
3	**Thermal Imaging Videos**	*'…It was good because you get to see how… like how long a thing can get cooled down. It was really interesting…'* **Student 6**	3	**Thermal Imaging Videos**	*'…We thought this one because now we know how long it takes to cool down a hair straightener, a cup of tea and a hot water bottle. So now we know when we*	3	**Thermal Imaging Videos**	*'… It was really cool to see. I have never seen that before. It helped me understand what we were talking about. Like we could see it. Stuff like that really helps…'* **Student 1**

					can be more safe…' **Student 2**			
4	**'How-to' Videos**	*'…Yeah cos they were like us and about us. Like your friends. Like they were in your kitchen. Like it was at home and could be us…'* **Student 4**	4	**3 C's**	*'…We picked this one because I think cool, call and cover is a good phrase to use so then we know what to do and we can remember…'* **Student 1**	4	**'How-to' Videos**	*'… The kids were really good. It looked real. Like it could be us. It showed me what to do rather than just talking about it. It helped me learn because I will remember them…'* **Student 1**
5	**3 C's**	*'… It was a bit long. There were lots of things to learn. I can remember it. But it got a bit boring waiting…'* **Student 3**	5	**'How-to' Videos**	*'…I liked that one because it showed us how to do the things like it was us. Because the children looked like us and said the things it was like we were doing it. So like we can do it safely too. And we can help someone too because they can…'* **Student 4**	5	**3 C's**	*'… I liked this one. It was quite long but I learnt a lot. It was when we really learnt about what to do and why. It was good to learn that because sometimes you don't know why you do things…'* **Student 2**
6	**3 A's**	*'… Erm because we had to write stuff down… and that's boring…'* **Student 5**	6	**3 A's**	*'…Yes we had to do some writing and there weren't really much ideas of our own because most of the ideas were in the program. I found it hard to come up with my own ideas…'* **Student 3**	6	**3 A's**	*'…It was my least favourite because we had to write down. Write down all the things…'* **Student 6**

*Indicates level of school FSM status

7.3.8 Suggestions for Improvements

Several small suggestions for improving the intervention were made by students and teachers.

7.3.8.1 Students suggestions for improvements

Students suggested that increasing interaction would improve the intervention. Students across the three focus groups provided the following ideas:

1. First-aid role play

Several children discussed the idea of a 'pretend' first-aid role-play. Students should work in small teams or pairs and be provided with a burn situation. They would have to come up with a short drama scene about how they would handle the situation, the first-aid that they would perform, and how they could have prevented the injury from happening. A few suggested that this could be shown by the group to the rest of the class, each in turn watching one another.

> *"… Like pretend first aid. Like acting. You could pretend by going into partners or groups and say we could have these pretend burns and first aid boxes and then… and we could pretend the other person has a burn and we could do it ourselves. Solve their burn… Yeah we could have a role play to do and we could show everybody ourselves. We could show the class…"* **Focus Group 1, Student1**

2. *Burns Story*

A few students suggested they could write a story or a comic board strip of a 'burn story'. Similar to the role play, the story would include the incident and what happened afterwards and how they may have prevented it from happening.

> *"… So we could imagine we had a burn and write a story about it. Like what happened, how we treated it and how we could have stopped it from happening. Everyone could imagine it so they would all be different…"* **Focus Group 3, Student 5**

3. First-Aid Boxes

Students suggested that in small groups or pairs, they could be provided with a first-aid box and burn injury scenario to test their knowledge of appropriate first aid. The first-aid box would contain both appropriate and inappropriate materials and messages for how to prevent or treat a burn and students would pick the correct treatment. Figure 1 Appendix 62 shows an example of how students expressed this idea in a draw and write exercise.

4. *Draw a Burn*

As many students did not like the picture of the burn used in the intervention, students suggested that they could draw and design imaginary burn injuries. Figure 2 in Appendix 63 shows an example of a burn that students drew in a draw and write exercise.

One other suggestion made by a few students was to use cartoons, instead of videos. Students suggested that the use of cartoons may help to engage more students and increase their concentration with the content of the videos.

> *"… because children watch comic cartoons and they are used to looking at it. So say if someone was being naughty and not really looking it may make them look and watch. If it's a cartoon… well kids like cartoons so they will look at it and learn how to do the burns…"* **Focus Group 2, Student 3**

7.3.8.2 Teacher suggestions for improvements

Teachers' suggestions for improvements related to when the intervention should be delivered, and the format of delivery. Several teachers thought that the intervention should be delivered in the autumn term when there is a heightened risk of burns around Halloween and Bonfire Night. Teachers suggested that delivering the intervention as they taught about the history of these events would be more timely and help recall during a period of heightened risk burns. However, teachers did note that the autumn term was very busy and in the summer term, when examinations were over, there was more flexibility in the curriculum for extracurricular activities.

"… yes I think the autumn term, because there's lots going on and it can be linked in like Halloween and Bonfire night. So it would be an easy way to link it again for them to outside the classroom. And as a school we could extend the safety but in the home generally…" **Teacher 3**

Some teachers suggested that due to the activity based lesson plan, that instead of using two lessons to deliver the intervention, the activities could run over a few weeks instead (such as 6 x 30 minutes). Teachers suggested that this approach would emphasise the importance of the subject and repeat main messages to aid recall and application by students. Teachers also associated this approach with addressing the possible barrier of short attention spans of some students.

"… yeah I think possibly six lessons of 30 minutes across a half term I think would be… it may just… well repetition always helps… and it was very engaging but for those with shorter attention spans it might be better. It would also fit into our planning a bit easier – like if we were to do it again we wouldn't have to take over a whole lesson…" **Teacher 6**

7.4 Feasibility and Acceptability of the Research Study Methods

7.4.1 Consent Procedures

All parents and teachers commented that they were happy with the consent procedures used within the main study (parental opt-out). The acceptability of opt-out consent was strongly related to their beliefs that burns were an important topic and awareness of other health topics in the school curriculum. A few parents also suggested that they would be happy for the intervention, and the before and after testing, to be conducted without parental consent. They noted that they were shocked that personal safety and first-aid were not taught at present.

"… but to be honest I would be more than happy for that to have happened without even knowing about it sort of thing. I think because of what it is about, it isn't particularly sensitive like other things. If you teach it in the right way it can only be a good thing for all children to learn about. I would be happy for it just to be taught. I think it should be…" **Parent 5**

7.4.2 Data Collection Techniques

The 'clickers' used to gather before, after and retention testing data were extremely highly regarded by students and the teachers. Students expressed excitement at being able to use the clickers as they were novel, interactive and technological. No students commented that they felt like they were being tested and enjoyed being able to answer the questions. Across all focus groups, students noted that the use of clickers meant that they could answer questions personally, receive real-time group responses, and provide answers without being singled out for being correct or incorrect.

"… And when we did the click thing… we could click an answer and then if people didn't agree with it they wouldn't know that you had clicked that one and that was good because they didn't know because we had our own ones…" **Focus Group 1, Student 6**

Many teachers thought the success of the intervention could be attributed to how little students knew about preventing and treating burns before the intervention, and how much they knew after. The students actively strived to do better in the questions at the end of the intervention. This lead, the teachers believed, to increased engagement and involvement. Some teachers recognised that they may not have access to clickers depending on how the intervention may be delivered in the future. To address this issue, many suggested that using the same format of multiple choice answers through a different medium (such as whiteboards or answers cards).

"… And I know what made it so exciting for the children was having the clickers which you know I don't know if we would be able to access those or they could be provided. But you could still do something where you have a card or something to turn over for children to answer. You know like A or B or whatever. I know they were used to assess their understanding pre and post sessions for the study, but they would still be important… they like to assess themselves. It gives them something to work towards, beating their own score…" **Teacher 3**

7.5 Emergent Themes

Emergent themes were identified through inductive coding of transcripts, as discussed in chapter 5, section 4.

7.5.1 Co-learning

All the students and teachers referred to instances of co-learning and group-participation as being important factors within the intervention. Co-learning, also known as 'collaborative learning', is defined as being a situation in which two or more people learn, or attempt to learn, something together (Dillenbourg, 1999). Co-learning existed between students, teachers and at times both. For students co-learning was linked to enjoyment, altruism and increased creativity. Students thought that the activities during which they worked in a pair or a small group to be more enjoyable and were more conducive to co-learning [Table 35]. Students reported that they felt able to help each other in the present and the future and others who are hurt. The expression of increased creativity was associated with having different ideas that they could share and build-on together increased student understanding of the topic and a level of ownership over their learning.

"… All of this that we have done has made us work together really well and to help each other. So I think that is very fun and interesting for us…" **Focus Group 3, Student 6**

"…Because we can all work together and we get different ideas. And when we get different ideas we get lots of ideas and learn more about the burns…" **Focus Group 2, Student 3**

Teachers also noted that they enjoyed engaging in active learning alongside the students in relation to learning about burn prevention and treatment. All teachers stated that they learnt a lot from the intervention. Many explained that it was novel to increase their knowledge and first aid skills alongside students. All the teachers expressed shock at their lack of understanding of burns prevention and first aid.

"… It was great to learn alongside the children. Obviously it was enjoyable for them too, but I really enjoyed not being the teacher for a little while… It was special learning with them and joining in with their conversations and their ideas. Because I had such little knowledge it was like being a student too. They embraced me as one of them…" **Teacher 3**

7.5.2 Health Promotion, First-Aid and the School Curriculum

Parents and teachers recognised the tight time constraints set by the packed curriculum and how this did not offer a lot of time for extracurricular activities. However, all expressed their wish for students to engage in more extracurricular activities, especially those relating to students' health, wellbeing and personal safety.

"… I think it is part of growing up isn't it, learning about how to look after themselves and how to look after others and be aware of their bodies…" **Parent 4**

"… I think it's not something that is currently covered in the curriculum we would touch on some elements of first aid but not in such depth… I think the children are more than capable. So I think it's an element that is neglected…" **Teacher 2**

This was of particular importance for those teachers from schools with a high FSM status. These teachers recognised concern that within the home and community lives of students

they may not receive the level of health or life skills education that other students do, or that they would not come into contact with such education from other sources (such as Cubs or Brownie groups) due to financial implications.

> *"… I think for a lot of the students that we have its even more important… because some of them… obviously not all of them but some of them don't get these things at home. So if we don't cover it in school who will teach it to them?... To me this stuff is almost more important…"* **Teacher 6**

Several parents also recognised that although a few elements of personal safety are incorporated in the guidelines of the national curriculum there is a gap in the curriculum concerning first-aid. Following their increased awareness (from talking to their children and information provided on study documentation) many parents remarked that they actively believed that more injury prevention and first-aid should be taught in schools.

> *"… well I have been teaching for over 15 years and I have never taught them anything about injury prevention, I don't think there is anything out there on it…"* **Parent 3**

7.5.3 Childhood Home Experiences

Many students and teachers often referred to their own personal and home experiences during intervention delivery. The majority of teachers reported that the experience made them appreciate how little they knew about their students' lives outside of school, and how little time they had to explore this within the classroom. Several teachers indicated that they believed that the sharing of personal and home experiences improves and enriches the quality of the students learning.

> *"… because the one thing it made me think about was how little as their class teacher we know about… just about what they get up to on a daily basis outside of school… and for the first time in a long time I had the time to sit, listen and discuss that with them…"* **Teacher 6**

"… we don't give our children that we teach enough opportunity to talk about stuff that is going on in their lives really. So I think anything which they're really got the sort of experience and knowledge base thing from can only improve the quality of the learning that they do…" **Teacher 6**

"… they had the chance to learn from one another… you know talking about their own experiences, it's real to them, and all so different. And yeah I think that is much more powerful for their learning…" **Teacher 2**

7.5.4 Burn Experiences and Childhood Risk Perception

A majority of parents shared personal burn stories during their interviews.

"… I think like so many things you think it will never happen to us. You just aren't aware. We always thought we were so safe and careful. I think people just need to know that it can happen. How easily it can happen…" **Parent 3**

"… I mean my youngest got burnt with a sparkler last year and it was despite having all the thick protection and despite us going on and on and on about you know that you could get burnt and all the precautions. He still just wanted to find out what would happen. He was just curious…" **Parent 4**

"… because kids are more likely to get injured because they are curious or because they are not really aware of the dangers…" **Parent 4**

"… especially with junior aged children, when they start to be kind of independent. They start exploring and don't really have any idea of the risks. I don't think they don't even think about it…" **Parent 3**

"… kids seem to do a lot without thinking about what could happen…" **Parent 2**

The narratives of the burn injuries stories commonly attributed the injuries to low levels of risk perception by children. Parents portrayed the children's low risk perception to be heightened in those who are young due to a lack of awareness of danger and understanding of consequences. Parents also expressed that the natural states of curiosity

and exploration that children have, combined with low risk perceptions, heightened their risk of burn injury.

7.5.5 Public Knowledge and Awareness of Burn Injuries

All participants expressed a lack of understanding and awareness of burn injuries prior to the intervention and expressed a desire for children to be taught prevention and first-aid at a younger age.

> *"… we have had a scalding accident ourselves and I was very ignorant. I had no idea what to do. So I was really pleased that this was happening. Now hopefully what happened to us will never happen to him…"* **Parent 3**

As previously noted all teachers expressed worry and concern at their personal lack of knowledge of burns first-aid, but also expressed the overall lack of knowledge of others in the school environment. Many brought up their concerns, speculating what would occur prior to the intervention if an individual had sustained a burn injury in the school environment. Many teachers suggested that they would refer their concerns back to the SMT and address the issue.

> *"… When I think about how little I knew it's shocking really. And how little all of us know. Even when I was talking to other teachers none of us knew. It was frightening really… It just made me stop and think – what if something had happened at school? None of us would know what to do. This is so important…"* **Teacher 3**

> *"… I think quite a few of the things you said surprised and shocked me and I was like 'Oh my God'… I think it's just great that you're targeting young children sooner rather than later as it's something even a lot of adults don't know. After a lot of things you were saying I was thinking to myself 'Oh my gosh really?'… It's quite*

scary how little sometimes we know… Just makes you stop and think. What would we do in school?…" **Teacher 4**

7.6 Discussion

Results of the study indicate that the intervention was acceptable to students, parents/carers, teaching staff, school SMT and key stakeholders. Acceptability was strongly attributed by students, teachers and parents to student enjoyment and engagement and the perceived benefit of the intervention to parents, teachers and school SMT. Perceived benefits included the improved risk perception of students, increased student empowerment, confidence, safety knowledge and understanding of the importance of safety as a topic. However, some suggestions for improvements were made. The main facilitator identified by teachers and SMT was ease of integration into the curriculum and the incentive of BFAT training element (opposed to just prevention). The biggest barrier was rigidity in the curriculum and who would deliver the intervention in the future.

Several burns prevention interventions for school-aged children have assessed acceptability of the intervention (Frederick et al. 2000; Harre and Convey, 2000; Mondozzi and Harper, 2001; Azeredo and Stephens-Stidham, 2003; Kendrick et al. 2007; Morrongiello et al. 2012; Lehna et al. 2013), however none assessed the acceptability to the students themselves. Findings from these studies mimicked results in this study in that students find the topic of burns prevention to be of interest to students (Mondozzi and Harper, 2000), practical activities increased student engagement (Azeredo and Stephens-Stidham, 2003) and parents deemed the topic to be important and should be covered in schools (Frederick et al., 2000).

To the authors knowledge no previous studies have explored the feasibility of delivering BFAT training in primary schools to a level that would meet current recommended guidelines. A few studies have however, explored the feasibility of delivering first-aid for other injury types and events to school-aged children (Uray et al., 2013). Findings from the

Uray et al. (2013) study found that students aged 6 – 7 years were highly receptive to receiving first-aid training. The topic was also explored during the FAST study (The feasibility of using a parenting programme for the prevention of unintentional home injuries in the under-fives: a cluster randomised controlled trial, Mytton et al., 2014), though the intervention was delivered to parents/carers of those less than five years, it received a largely positive evaluation from participants, deliverers and stakeholders.

Of particular importance to teachers and school SMT for Learn About Burns was the ease of integration with the curriculum. This is mirrored in other school-based prevention programs such as the Wyatt et al. (2011) pilot study assessing the development, feasibility and acceptability of a school-based obesity prevention programme - HeLP. Interestingly, the HeLP intervention was also designed in-line with the MRC developing and evaluating complex interventions guidance (Craig et al., 2008) and had several similar findings to the Learn About Burns feasibility study. Similarities included a high level of enjoyment of students during practical/drama activities that had a positive effect on self-esteem of students, increase student relatability to materials as they incorporated young actors like them, and a discussion on who was best to deliver the intervention (external facilitators or teachers). The study also demonstrated extension of intervention effects to the home environment where students were talking to family and friends. Commonalities that proved to increase feasibility and acceptability in both interventions could have important implications for future research in the area.

Qualitative results reinforced quantitative findings as a correlation between student enjoyment and learning existed - those tasks that students ranked as their favourites during focus groups corresponded to the knowledge and safety messages that showed the most improvement.

Two main barriers were identified for future implementation. The first was the time constraints and rigidity of the school curricula. Teachers and parents identified the need for

students to receive more education on health promotion and well-being within school though recognised the difficulty of this with a busy curriculum and current educational targets. This was especially important to those teachers from schools with a high level of FSM eligibility. Although many schools in Wales teach to a topic lead curriculum which allows more flexibility, teachers raised concerns of the lack of time to address issues such as personal and social education and the additional holistic needs of the child. In 2003 the WHO conducted a series of work on school health and published a number of information reports. A key report in this series was on 'Improving Health Through Schools' (2003). Within this report evidence is provided for the utilisation of schools as ideal settings for health promotion and the emerging concept of the health-promoting school. To do this day schools are expected by national agencies and international bodies to deliver health education to students, however results of this study suggest that teachers feel that not enough time is protected within the timetable to do so effectively due to the burden of meeting academic targets.

The second main barrier identified related to who was best suited to deliver the intervention in the future. Although teachers suggested that they would be happy to deliver the intervention in the future if adequate training were provided, differing opinions were aired on whether the intervention would be as effective if an external provider did not deliver it. When considering sustainability of the intervention were teachers to deliver the program and a train-the-trainer approach be utilised this could reduce the burden on external providers and reduce the cost. However, initial monetary and time investments would have to be provided to develop a training plan and materials with additional long-term checks on fidelity of delivery of the intervention. Alternatively, if external providers facilitated the intervention then these additional costs would be removed if personnel such as burn research nurses were able to deliver the intervention as part of their outreach

portfolio. This however, would be a less sustainable approach as it would rely on the availability of personnel with the correct prior training and time.

Strengths of this qualitative study methods include the thorough assessment of acceptability and feasibility of the intervention and study design at all levels (from students to stakeholders). Views and feedback were sought from staff, students and parents from each group in a manner that was most appropriate for them. This led to different data collection techniques and activities being used that most suited students, parents and teachers.

A limitation could be the possible bias attributed by the qualitative data collection and sampling methods. Telephone interviews were employed for interviews with teachers and parents. The use of telephone interviews has been contested repeatedly in the academic literature as a means of gathering qualitative data (Novick, 2008; Cachia and Millward, 2011). Reported disadvantages of this method relevant to the current study include: possible lower response rates, need for a shorter interview duration and absence of visual, or, nonverbal cues (Aday, 1996; Bernard, 2002). However, the increased versatility and privacy offered by this method for those hard to reach groups (such as teachers and parents) advocates this method when conducted appropriately (Carr and Worth, 2001). Practical suggestions offered by Burke and Miller (2001) to counter-act possible disadvantages were employed including establishing contact or rapport prior to the interview and using a prepared script to introduce the study.

Additionally, an opt-in consent model was used with parents having to return slips expressing an interest in taking part in an interview to the teacher. This method has the potential to bias the sample towards people who were motivated to take part in research, meaning that those parents who took part are already more engaged so results of acceptability could be inflated. A blanket invitation to all parents of recruited students was conducted to try and counter-act this.

The same limitation could have affected the focus groups. Focus groups were conducted with students as previous studies have shown a smaller group size can make children feel more comfortable, and closely mimics the size of group commonly used in a primary school. Due to the opt-in parental consent and student assent models used it is likely that the sample was biased towards those children who expressed higher levels of engagement with the intervention. Efforts used to counteract this included a blanket invitation to all students who were recruited and the explanation to students that anyone could take part, even those who did not like the intervention or thought it could be better as I was interested in knowing what they really thought.

Finally, researcher bias should be acknowledged. All qualitative research was gathered and analysed primarily by the author of this thesis which could introduce researcher bias. Best efforts were made to counteract this including double-coding of qualitative data, a personal reflection log was kept throughout the PhD (through PPI exercises, intervention development and feasibility testing), qualitative mentoring and constant reflexivity was endorsed throughout data collection, analysis and writing stages.

7.7 Chapter Summary

Results from the qualitative data compliment and add to those from the quantitative data in suggesting that the intervention is acceptable and feasible at all levels so that wider piloting of the intervention should take place following refinement. The qualitative data provide an interesting insight into the wider societal, educational and political topics that could influence integration of Learn About Burns into the curriculum and concerns that teachers have regarding their place in student holistic development. All teachers and parents recognised their lack of knowledge of burn injuries, mechanisms of prevention and appropriate first-aid and raised concern about what would have happened if an accident had ever occurred.

Chapter 8: General Discussion

8.1 Chapter Introduction

The studies presented in this thesis have led to the development of a novel evidence-based burns prevention and first-aid intervention for school-aged children (8 - 9 years). This thesis addresses an important gap in the injury prevention field. To the authors knowledge, Learn About Burns is the first intervention to target *both* burn prevention and BFAT in this population. Learn About Burns was developed in accordance with the MRC developing and evaluating complex interventions guidance (Craig et al., 2008).

8.2 Identifying the gap

A general literature review (reported in chapter one of this thesis) identifies the need for intervention for this age-group. The review confirmed, that although children less five-years-old have the highest risk of obtaining a burn injury (Kemp et al., 2014), burns to school-aged children (5 – 16 years) still pose a significant problem. Burn injuries come at a high physical and psycho-social cost to the child and their family (Sheridan et al., 2000; Kent et al., 2000; Hall et al., 2006; Corry et al., 2009; Landolt et al., 2009; Peleg et al., 2011; van Barr et al., 2011), and at a high monetary and resource cost to the NHS (Pellatt et al., 2010). Efforts to counteract this can include prevention of injury and provision of appropriate delivery of BFAT. Burns first-aid has been shown to reduce the severity of a burn injury, reduce the extent of acute and ongoing treatment required and improve outcome if provided effectively and appropriately (Ofeigsson et al., 1968; Sawada et al., 1997; Nguyen et al., 2002; Hudspith and Rayatt, 2004; Cuttle et al., 2009); however, it is poorly administered and population knowledge of the correct BFAT is low (Skinner and Peat, 2002; McCormack et al., 2003; Graham et al., 2012; Davies et al., 2013). Therefore, there is a

need to prevent these injuries for school-aged children and improve BFAT knowledge and practice for when they do occur.

8.3 Contribution to knowledge one: a systematic review evaluating interventions to prevent unintentional burns for school-aged children

A systematic review was conducted on what burn prevention interventions prevent unintentional burns for school-aged children (reported in chapter three of this thesis) to identify the existing evidence base following the development phase of the MRC guidance (Craig et al., 2008) and inform the development of the intervention logic model, content, materials and method of delivery.

The review highlighted a research gap in this field. There were few studies that focused on burns prevention for school-aged children, studies were of poor methodological quality and no overarching elements of what is effective in school-age burns prevention could be identified. There was some evidence that prevention interventions for unintentional burns for school-aged children can be effective across the areas of knowledge, attitude and practice.

Previous reviews have been conducted that address questions surrounding how to prevent unintentional injuries to school-aged children for several injury mechanisms (such as head injuries from riding bicycles and dog bites), and many have found the same limitations in the existing literature as presented above (Duperrex et al., 2009; Owen et al., 2011; Richmond et al., 2013). The most recent Cochrane Review on the topic by Orton et al. (2016) found insufficient and low-quality evidence to support the effectiveness of school-based educational programmes in preventing unintentional injuries, suggesting the need for further high-quality research to evaluate this effectively.

Evidence may be of low quality due to a number of factors. Firstly, as shown in the results of this review, there has been a lack of development studies in this area. Little, if any,

information is provided on any development work prior to the effectiveness study reported in the publication. Development work has been deemed crucial for good intervention and study design for almost two decades (van Teijlingen and Hundley, 2001). This lack of development and piloting may have led interventions to be formally evaluated before issues with content and implementation were addressed. The lack of developmental studies may be due to the lack of research funding explicitly for complex intervention development. This may have therefore meant few studies were developed and if they were, there was not enough resource to identify and address problems with interventions. It could be argued that this work may have been completed but not published (Lancaster, 2015) and the advent of journals such as 'Pilot and Feasibility Studies', the importance placed on development and piloting in the MRC guidance (Craig et al., 2008) and advent of funding streams such as the MRC's Public Health Intervention Development fund, may help to increase the number and quality of interventions developed.

Secondly, few studies used randomised evaluative designs. The majority of studies were controlled before and after studies such that there was no counterfactual comparator. Systematic reviews in other areas of injury prevention such as the prevention of falls in the elderly and prevention of sports injuries (Chang et al., 2004; Aaltonen et al., 2007) frequently have a higher proportion of RCT publications that meet inclusion criterion compared to child injury prevention reviews (e.g. Towner et al., 2001) with some only including RCTs. There is a need for more RCTs of burns prevention and BFAT interventions, especially when evaluating effectiveness.

Thirdly, a majority of publications were marked as poor quality when compared to reporting standards. Poor reporting makes it difficult to assess the true quality of evidence and the risk of bias within a study. Poor reporting can lead to high-quality studies being assigned a high risk of bias and ultimately deemed to contribute low quality evidence. The current review would recommend that reporting needs to be improved of the intervention

(full details of what it is and how it is delivered) and the study methods (especially recruitment). A majority of included studies did not use recommended standardised tools/checklists (e.g. the TiDieR checklist or the CONSORT statement) to optimise study quality and standards of reporting.

The systematic review is the first that I am aware of to assess and synthesise the international literature on the subject, providing researchers with further understanding of the extent to which existing interventions were effective, the quality of evidence to date, and identifying future directions for the field.

The following contributions were made to existing knowledge:

1. Reporting of interventions (development and study methodology) is often insufficient to gain a full understanding of the proposed mechanisms of change which underpin an intervention and how it was tested for effectiveness.
2. There is a dearth of burn prevention interventions:
    a. for those attending secondary school (aged 11 – 16);
    b. that target non-fire related burn injury;
    c. evaluations that measure actual effect on injury rate.
3. Evaluations of burn prevention interventions do not often assess acceptability and feasibility (especially for those directly involved – the children and instructors/facilitators).
4. Further research is necessary in the burns prevention field to further develop prevention interventions that meet the needs of the population, are grounded in clear intervention theory, and follow the steps of the MRC developing and evaluating complex intervention guidance (Craig et al., 2008).

As the systematic review did not provide conclusive answers for the content, materials and methods of delivery for the intervention, further information was sought from education and behaviour theory for development alongside lessons learnt from the review.

8.4 Contribution to knowledge two: a cross-sectional epidemiological study of unintentional burn injuries occurring to school-aged children in England and Wales

The epidemiological study (reported in chapter two) showed an increase in the prevalence of burn injuries around 11-years-old primarily relating to the preparation, consumption and carrying of hot food and drinks. Children of this age were more likely to sustain their injuries at home in the evening. A key finding that reinforced the need for an intervention to promote BFAT in school-aged children was that **only 1.3% of all injuries received BFAT in-line with the BBA first-aid guidelines (2014)**. These results justified the need for an intervention to address the agents and mechanisms of these burn injuries around food and drink preparation, alongside BFAT training to increase knowledge and correct use if and when injuries do occur.

The results differed from previous studies that have reported an increase that burns occurring to those of a secondary school-age (11 – 16 years) are attributable to an increase in risk-taking behaviours combined with the increased autonomy (Kemp et al., 2014). This study did not find burns from risk-taking behaviours were likely to contribute to a significant proportion of burns (3.2% of all burn to those over the age of 11 were due to explosive injuries, and 8.1% were due to flames). Moreover, a number of intervention programs exist to address high risk behaviours relating to fire such as arson and fire-setting prevention programs (e.g. Franklin et al., 2002 and Muller and Stebbins, 2007). There are, however, few which target food preparation in younger school children and none that teach first-aid alongside it which is crucial to reduce morbidity and improve the outcomes of burns.

In 2004 the WHO released 'Guidelines for conducting community surveys on injuries and violence' advocating their use to reveal different priorities per population and environment for intervention. The increase in prevalence of burn injuries at 11-years-old found in this study led to the intervention being targeted to Year 4 students (8 – 9 years old) with the

objective that by targeting Year 4 it was hoped that the intervention would have the maximum effect of intervening before the prevalence in injury rises. Consultation with teachers concluded that from a practical perspective Year 4 offered greater flexibility in their timetable with no national examinations that year, thus reducing potential barriers for implementation. The only other school-based burns prevention study in an OECD country that used a previous survey to assess what activities school-aged children were engaged with that carried a burn injury risk was Harre and Coveney (2000) and subsequently Moore et al. (2004). Results from this study (a survey of 421 children aged 7 – 13 years) indicated that involvement in risk behaviours (e.g. home activities involving hot water, fire or cooking appliances) increases with age and many children had assistance in these activities from young siblings (Harre et al., 1998). Results from this survey led to the intervention to target the identified risk behaviour such as running a bath, alongside increasing risk awareness for younger siblings – especially within ethnic minority groups. In other areas of injury prevention such as the prevention of drowning (Agrawaland and Hyder, 2018), evidence on causes has more clearly informed the content of interventions. An example of this is that following household observations in Bangladesh playpens and door barriers were provided to address the needs and risk behaviours of the population (Agrawaland and Hyder, 2018). The lack of using epidemiological research on the age when prevalence is highest, mechanisms and agents in burns prevention, raises the question of the suitability of interventions to the population, relating back to the lack of intervention development work.

8.5 Contribution three: Learn About Burns a school-based burns prevention and BFAT promotion intervention

The systematic review and epidemiological study informed the design of the Learn About Burns intervention. These studies found that burns are occurring to school-aged children, there is no intervention that addresses the burn mechanisms and agents that are likely to

cause them injury, and there is extremely poor knowledge and application of the BBA (2014) recommended BFAT guidelines. Intervention development comprised of several exercises making use of forward and reverse logic model exercises, PPI exercises, consulting existing literature and programme theory (reported in chapter four of this thesis). Once the logic model was developed, prevention and BFAT messages were developed, and the method of delivery determined. The intervention took place over two days and two lessons and the learning outcomes covered in lessons related to the outcomes in the logic model.

A logic model was developed to provide a plausible and sensible model of how the program will work in pre-set environmental conditions (Bickman, 1987). This is especially important when undertaking collaborative intervention development with inputs from a number of different groups and stakeholders; as is advocated for in injury prevention research (Helitzer et al., 2009). Orientating discussions around outcomes creates a shared understanding of the set goals of the intervention and can facilitate communication between groups (Wholey et al., 2010). Logic models also consider the intervention holistically and lead us to challenge underlying assumptions and resources needed for effective delivery and later implementation. A consideration frequently faced in relation to these factors is the long-term scalability of the intervention and its integration with current policy and practice. These considerations are often given insufficient attention at this development stage (Milat et al., 2013). Making preliminary considerations at this point can be beneficial to the life course of the intervention and feasibility of uptake and later integration into practice.

However, logic models also have their limitations. Developing a logic model can be a lengthy and costly process and recognition needs to be paid to the fact they are only conceptual representations of programs. Due to this, attention needs to be paid to alterations in environment of delivery and change in population which would subsequently

alter preconceptions of how the intervention works through processes in the model or the inputs, outcomes or assumptions (Savaya and Waysman, 2005). Due to this logic models should be viewed as constantly active and developing and several iterations may exist in the life course of an intervention.

8.6 Contribution four: feasibility testing and examining the acceptability of the Learn about Burns intervention

The main result from the feasibility study was that the intervention was feasible and acceptable, and that wider scale piloting should take place following intervention refinement. Analysis of qualitative data indicated that students and teachers thought the intervention was enjoyable for students, kept them engaged, and integrated with the curriculum and classroom timetable. Take home materials were provided to participants in an attempt to reinforce and disseminate more widely burn prevention and BFAT knowledge to home environment. A number of parents reported that they had acquired new knowledge about BFAT from the intervention.

A before and after study design was employed and quantitative results suggest that the intervention increased student burn prevention and first-aid knowledge, student self-efficacy towards burn prevention and to provide burns first-aid and increased appropriate safety practices at a six-month follow-up. There was no control group, so it is possible these changes are not attributable to the effect of the intervention. However, the magnitude of the changes observed were relatively large. Student recruitment and retention rates were high, and missing data were low suggesting the recruitment and data collection procedures were acceptable and have the potential to work on a larger scale.

Of importance to teachers and school SMT was the ease of integration with the curriculum. In 2015 Pearson et al. (2015) conducted a realist systematic review of research and experience of implementing health promotion programmes in school in the UK. Results were used to develop four programme theories for how to effectively design and

implement programmes in schools (Figure 32). The four programme theories were: 1) Preparing for implementation, 2) Initial implementation, 3) Embedding into routine practice and 4) Adaptation and evolution. This feasibility study addresses 1) preparing for implementation and 2) initial implementation theories. Results from interviews and focus groups suggest the study addressed the goals of stages one and two were met, and the messages of the intervention might be able to be embedded into lessons by teachers.

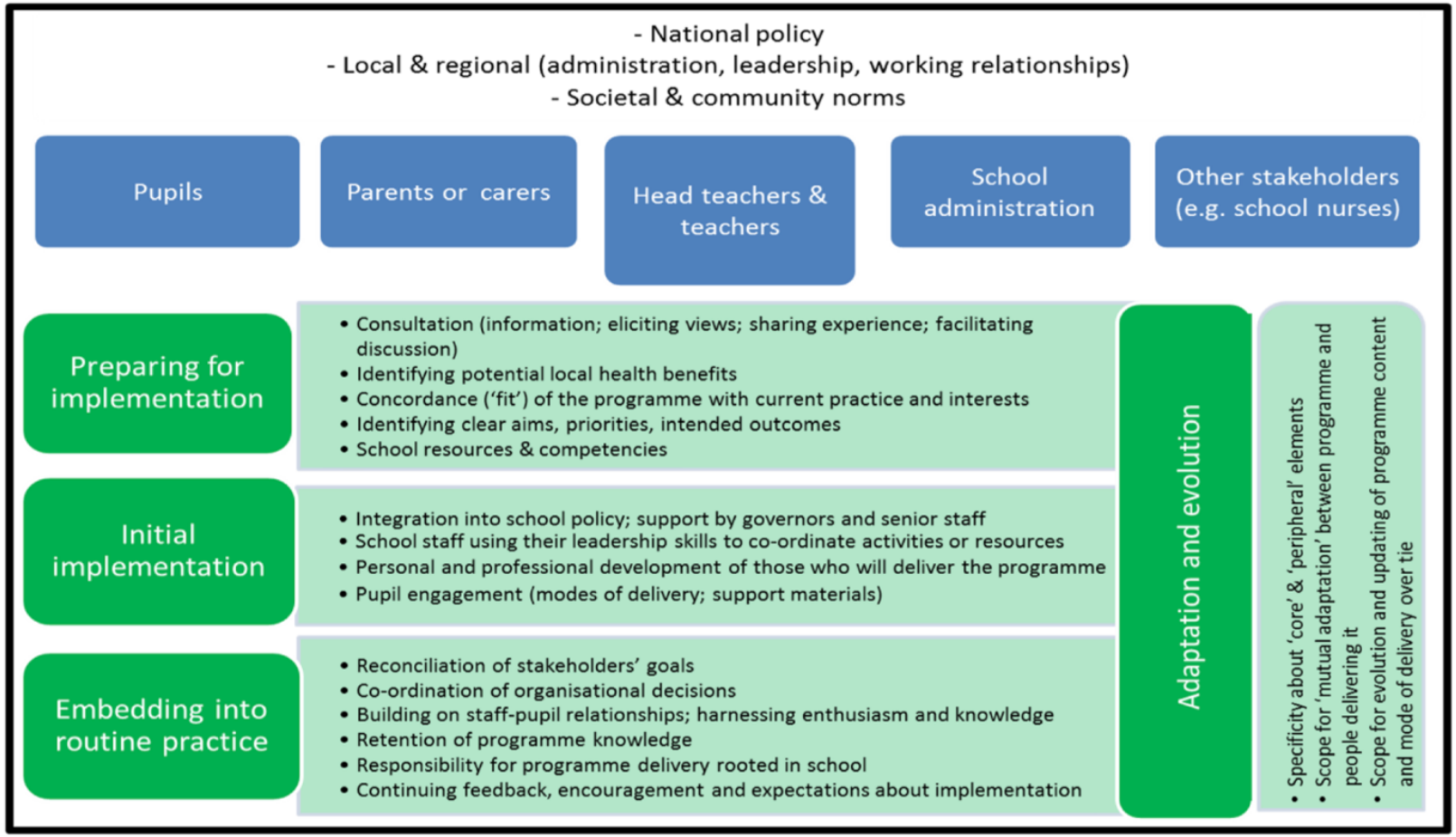


Figure 32 - Conceptual framework for designing and implementing health promotion programmes in schools (Pearson et al., 2015)

Increases found in knowledge, attitude and practice mimic those results reported in publications included in the systematic review (e.g. Frederick et al., 2000 and Chavez et al., 2014) and studies included in the Orton et al. (2016) review that reported out of the 21 studies that assessed safety knowledge, 19 reported an improvement in at least one knowledge domain. A major criticism across all injury prevention research is the lack of evaluations that do, or try to, assess a reduction in injury events. Measuring injury reduction is hard without widespread interventions at a level to effect population change and good measurement systems with accurate data – especially when injury events are relatively uncommon. In the context of burns, only those requiring medical care are recorded and not those that are treated in the community, which is likely to be the majority.

There could still be an underlying assumption that changes in knowledge and attitudes will affect changes in practice. Burn prevention strategies focusing purely on knowledge, may be ineffective (Linares and Linares, 1990). Ajzen's Theory of Planned Behaviour is based on the premise that intent, formed by attitudes, is the most important precursor to behaviour change (Ajzen, 1999). The theory is frequently used in relation to injury prevention interventions, especially bicycle helmet and car seatbelt use. Based on this theory, it is important to address attitudes when aiming to change practice. Another criticism that could be levied against the changes in knowledge and attitudes is that changes could be short-term and not have a long-term impact However, the retention test data found changes persisted at the six-month follow-up. can provide data on: 1. Secular trends in policy implementation or environmental changes; 2. intermediate effects of the intervention and 3. maintenance of effects after the intervention is over (Doll et al. 2003). This data is particularly useful for interpreting results in the absence of a control group (Doll et al. 2003).

There was sharp increase in scores from baseline to post-intervention delivery and the six-month retention results of this study provide more promising evidence of the students learning and processing safety messages and behaviours from the intervention. Although results show a small decrease compared to post-intervention follow-up (this is to be expected) the increase from baseline suggests students retained information of the key intervention messages.

8.7 Critical review of the Medical Research Council guidance to develop and evaluate complex interventions

The advantage of using the overarching framework of the MRC development and evaluation of complex interventions for Learn About Burns (Craig et al., 2008) is that the intervention is evidence-based throughout and tailored according to findings for the population. The positive findings of the feasibility study suggest that Learn About Burns has the potential to meet the needs of the population, have a sound theory base, and by addressing issues with implementation in the development phase, that which is taken forward to piloting is acceptable and feasible. The framework phases, if conducted effectively, are suggested to "lead to a well theorised and replicable intervention that could be assessed using a randomised control trial" (Mackenzie et al., 2010:185).

However, the guidance has previously been criticised for its overreliance and work with the development of pharmacological interventions. Pharmacological interventions often have large resources behind them which enable them to afford to go through several phases of development that lead to large scale effectiveness studies (Lakshman et al., 2014). These studies are delivered on an individual basis and thus open to RCT design. Funding for complex public health interventions to go through this process can be extremely hard to find and have been historically underfunded (Hemenway, 2009). Although successful national public health interventions are highly cost-saving, cuts to public health budgets during times of austerity act as a barrier in many HICs due to impacts on proposed

disinvestments for research studies – especially at the development level (Masters et al., 2017). If following the MRC guidance, a substantial amount of research funding needs to be secured for development, feasibility and pilot testing (and it is plausible that each of these steps could occur more than once). Due to this, it is hard to assess how true to the guidance public health intervention development actually is if funding cannot be secured for each of the phases, let alone reiterations of those phases. Historically, there has been a tendency to rush to full evaluations, which can fail on acceptability, feasibility, participant recruitment or participant retainment (Moore et al., 2018), and thus be a large waste of limited funding.

In light of this, consideration needs to be given for the lack of evidence on how to conduct exploratory studies. Though advocated in the guidance as a key step in assessing the value of progressing to, and identifying possible problems prior to, an effectiveness study, a recent systematic review by Hallingberg et al. (2018) concluded that existing recommendations for exploratory studies are inconsistent. Inconsistencies across recommendations include the aims, designs, conduct and information on when to proceed to an effectiveness study (Hallingberg et al., 2018). Moore et al. (2018) argue that this provides a challenge for researchers, peer reviewers and funders to evaluate the merits of proposals, outcomes and whether future evaluations are warranted. To address this the MRC has funded the GUEST study to examine current practice and expert consensus to develop guidance for exploratory studies that I am sure will be highly welcomed by academics.

The MRC guidance (Craig et al., 2008) has also been criticised for not acknowledging the complexity and unpredictability of the organisational systems into which interventions may be introduced (Hawe et al., 2009). Though efforts were made to counteract this in the 2008 update, researchers argue that the guidance views interventions as packages, rather than events in systems (Hawe et al., 2009). Guidance assumes that those interventions that

follow the phases through to implementation will produce an intervention that is stable and standardised (allowing for a level of adaptation to local settings) (MacKenzie et al., 2010). However, contextual variations within and across intervention sites or systems can create large flux effects to fidelity, appropriateness of content, feasibility and acceptability of interventions. Therefore, interventions constantly have to be adaptive post-implementation. Though reflexivity and bi-directional development is encouraged between development, feasibility and piloting, and evaluation phases, a question is left unanswered as to what occurs after implementation.

8.7.1 Personal reflections – overall strengths and limitations of this approach

Although limitations and critiques exist of the MRC guidance (Craig et al., 2008), upon reflection I believe this framework to currently be the best option for complex intervention development. The framework acts as a guide to ensure that interventions are evidence-based and developed with rigour to ensure that investment in evaluations is less likely to wasted – especially within a time of austerity. This is of particular importance for a niche research field such as childhood burns. Whilst it demonstrates a public health problem, the size of the problem (compared to other disease) is not great, it can be difficult to attract funding in a competitive field. If development studies can prove that the intervention is feasible, acceptable and suggest effectiveness at a smaller scale then funders are more likely to take notice. Findings from the thesis give me a strong basis to seek funding for a future pilot study.

Although it is used by the whole spectrum of academics it has been useful in aiding my understanding for what needs to be done and why, and what comes next. To this end, it has been a great learning tool on the life-cycle of studies/trials and how they can differ in theory and in practice, when to use different research designs and the importance of process evaluations.

Conducting the process in this format has also enabled me to network, foster and develop relationships with key stakeholders from the educational and public health sectors from inception. Relationships developed through PPI work have been key (and would be key in the future) to enable the development of this work. Fostering these relationships from the start enabled me to gain their input and understanding to the study, gain buy-in from the CHSS and allowed me to gain an in-depth understanding of the barriers and facilitators for this research that could be carried forward.

8.8 Is this approach novel?

The use of the MRC guidance (Craig et al., 2008) to develop an intervention is not novel. The original guidance was published in 2000, and although it is presented as a 'discussion document', the guidance is often viewed to be authoritative, so acts as the 'gold standard' for intervention development and is widely used (Anderson, 2008). Consequently, many publications of interventions report adhering to them, though provide little information on how they do so and offer no critique on the method. Unlike this programme of work many publications (such as Wyatt et al. 2011) report results of the feasibility/pilot study and refer to the iterative process of intervention development but do not report it. Publications on how interventions are developed or adapted for use, rather than just tested, are currently missing (especially within the field of injury prevention). Intervention development reports such as the National Institute for Health Research (UK) Public Health Research programme report for adapting the ASSIST model to ASSIST + FRANK (White et al., 2017) and the Hawkins et al. (2017) publication on developing a framework for the co-production and prototyping of public health interventions provide crucial insight for researchers on how to conduct this work.

8.9 Policy and practice considerations

Learn About Burns was found to be feasible for delivery and was complimented by teachers, parents and school SMT for ease of integration into the curriculum. Knowledge

gained from this work exemplifies the importance of mapping interventions to the school curriculum to make it as clear as possible for teachers to identify how the intervention addresses the public health concern, whilst addressing curriculum objectives of the year group or school.

Current educational changes in Wales lead by the Successful Futures Report (Donaldson, 2015), and heightened awareness of the importance of teaching first-aid in schools by the 'Every Child a Lifesaver' coalition in England, have implications for this intervention (especially for embedding it into the curriculum) and this field of research. It is key that researchers make the most of this changing climate to forward the progression of school-based health interventions and population level first-aid knowledge. Learn About Burns has the potential to contribute to this agenda.

8.10 Implications for future research

8.10.1 Recommendations for intervention refinement

If warranted, future intervention refinement for Learn About Burns would include moving the intervention delivery to the Autumn term so that content is delivered when teachers are already covering brief aspects of burn safety and public awareness is heightened surrounding Halloween and Bonfire Night. A future study would explore how to further increase interactivity for the students throughout the intervention considering the environment of delivery and class sizes, and how to incorporate student self-testing as part of the intervention (not just the evaluation).

8.10.2 Recommendations for further evaluation

The Learn About Burns intervention warrants wider evaluation. The intervention materials and questionnaire measures need to be refined before wider piloting. Where possible, further PPI engagement would feed into these improvements and changes would undergo brief informal acceptability testing with students and teachers.

Following this process, a larger pilot cRCT study would ideally be conducted across multiple sites is warranted. A cRCT design at the school-cluster level would be appropriate due to the group-based intervention delivery method and to reduce contamination between arms (in comparison to if classes within schools were randomised). The pilot cRCT would be used to gain further insight into potential preliminary effects of the intervention, provide information for a future sample size and feasibility of conducting a larger full-scale cRCT. At this point it is essential that new measures included to assess practice and reduction in injury are tested to ensure that the necessary data is collected accurately to assess effectiveness in future studies. This work would include the validation of student-self-report data (if still in use).

Findings from the feasibility study warrant a mixed methods approach during further evaluations. Historically researchers have debated the incompatibility and impossibility of qualitative and quantitative research methods being applied in one study (Foss and Ellefsen, 2002) due to their dichotomous assumptions about the phenomena that is being studied (Johnson and Onwuegbuzie, 2004). However, as long as researchers understand how and why each method asks and answers questions then they can be used together. A mixed methods design can be used to triangulate, to compliment and to enhance significant findings (Andrew and Halcomb, 2007). Without qualitative research in further pilot and effectiveness evaluations of the Learn About Burns intervention causal mechanisms and moderators could not be appropriately assessed. Therefore, effectiveness could not be attributed exclusively to the intervention. To this point, qualitative results have been invaluable in contributing to understanding why and how the intervention and study methods are feasible and acceptable, and improvements that could be made. Using both data types cross-verification has occurred and added valuable insight into how student enjoyment of activities relates to increased knowledge.

8.11 Conclusion

This thesis developed and tested for feasibility a school-based burns prevention and first-aid intervention. The Learn About Burns intervention was developed following the MRC developing and evaluating complex interventions guidelines (Craig et al., 2008) based on an evidence-base provided from a new systematic review and epidemiology study. Qualitative results from the feasibility study found the intervention was feasible and acceptable to students, teachers, SMT and stakeholders. The quantitative analysis suggests the intervention has the potential to increase student burn prevention and BFAT knowledge, improves student attitude and self-efficacy towards burn prevention and providing BFAT and increases appropriate practice for safety behaviours. These improvements found immediately post-intervention delivery were retained at a six-month follow-up. The Learn About Burns study warrants further evaluation following refinement using a pilot cRCT. The studies presented in this thesis make important contributions to knowledge in the field of burn prevention.

Appendices

Appendix 1 – Table of common burn injury agents, mechanisms and their definition

Agent	Definition
Hot Drink	All hot drinks (including but not exclusive to tea, coffee and hot chocolate)
Hot Food	All hot foods (including liquid food types such as soup and fats/oils)
Hot Water	All hot water (including steam)
Cooking Appliances/Oven	All cooking appliances (including but not exclusive to pots, pans and baking tins) and any area of the oven
Hair Styling Devices	All heated hair styling devices (including but not exclusive to straighteners and curling wands)
Iron	All household ironing appliances
Radiator	All household radiator appliances
Aerosol	All aerosol spray
Sun	All sunburn
Fireworks	All firework and firework-type agents (including but not exclusive to fireworks rockets, firework shells and hand-held sparklers)
Vehicle Exhausts	All vehicle exhausts (including but not exclusive to motorcars and motorcycles)
Petrol	All petrol substances
Outdoor Heat/Fire Source	All outdoor heat fire sources (including but not exclusive to BBQ/grills, chimeneas, fire pits and bonfires)
Mechanism	**Definition**
Immersion	Where the body site was immersed into the agent
Touch	Where the body site came into contact/touched the agent
Spill	Where the agent was spilt onto the body site
Fell/Ran into	Where the individual fell/ran into the agent
Pull down	When the agent was pulled in a downward motion causing the agent to make contact with the body site
Splash	When the agent splashed causing contact of drops with the body site
Exposure to sun	When the body site was exposed directly to the sun
Spray	When the agent was sprayed directly on to the body site
Explosion	When the agent exploded

Appendix 2 – Threshold for referral to Paediatric Burn Services. Detailed guidance provided by the National Network for Burn Care (2012).

Criteria		Facility Threshold	Unit Threshhold	Centre Threshold	Note
TBSA	**Refer**	≥2% <5%	≥5% <30% ≥5% <15% if under 1 year old	≥30% ≥15% if under 1 year old	
	Discuss			≥ 20% ≥ 10% if less than 1 Year Old	
Depth	**Refer**	All full thickness burns.	≥2% full thickness if under 10 yrs old ≥1% full thickness if under 6 months old	≥ 20% TBSA if Full Thickness	*All burns that are not blanching should be referred to a specialised burn service*
Site	**Refer**		Any significant burn to special areas (hands, feet, face perineum or genitalia) Any circumferential burn		*"Significant" can mean any injuries where the referrer feels that greater MDT expertise is required*
	Discuss	Any burn to special areas (hands, feet, face, perineum, genitalia)			
Mechanism	**Discuss**	Any chemical, electrical, friction burn. Any cold injury.			
Other Factors	**Refer**	Any burn not healed in 2 weeks.	Any predicted or actual need for HDU / PICU (including those predicted to require support for reasons other than the burn injury – e.g. smoke inhalation)	All those predicted to require assisted ventilation specifically for their burn injury for more than 24 Hours.	*Any child requiring assisted ventilation for >24 Hours must be within a Paediatric Intensive Care Unit.* *It is recommended that all children with smoke inhalation (irrespective of the presence of burn injury) are referred to a PICU with a specialised burn care service on site.*

Criteria		Facility Threshold	Unit Threshhold	Centre Threshold	Note
Other Factors	**Refer**		Any significant deterioration in physiology. Any burn with suspicion of non- accidental injury should be referred to a Burn Unit/Centre for expert assessment within 24 hours	Any child who is physiologically unstable as a result of burn injury	*Suggested parameters for physiologically unstable are:* *Requirement for Inotropic support* *Requirement for renal support or with deteriorating renal function* *A base deficit >5 and deteriorating* *An oxygen requirement >Fi02 of 50% and increasing, especially with abnormal C02 / respiratory rate*
	Discuss	Unwell/febrile child with a burn Any concern regarding burn injury any co- morbidities that may affect treatment or healing of the burn	All children with Major Trauma + Burn Injury (post treatment within Major Trauma Centre) where the burn injury meets unit level thresholds **Any** burn injury in a neonate should be discussed with a Burn Unit or Centre	All children requiring respiratory support All children with Major Trauma + Burn Injury (post treatment within Major Trauma Centres) where the burn injury meets centre level thresholds **Any** burn injury in a neonate should be discussed with a Burn Unit or Centre	*The treatment of children with Major Trauma + Burn Injury should be agreed between the Trauma service and the appropriate specialised burn service* *Neonates should only be admitted to burn services with an onsite NICU*

Appendix 3 – British Burn Association First Aid Position Statement (2014)

British Burn Association

First Aid Position Statement

There is variation in the first aid advice currently available for management of burns and scalds[i, ii]. Adequate and appropriate first aid has shown to impact on burn outcome, preventing further tissue damage and subsequent morbidity.[iii] A nationally agreed consensus is required regarding the optimum first aid for burns and scalds that is practical and effective to perform in the home or pre-hospital environment. The following recommendations are based on evidence from a formal systematic literature review.

1. Stop the burning process:

- Remove person from the source of the burn if safe to do so.
- Burning clothing should be extinguished using water or the 'drop and roll' method.[iv]

2. Cool the Burn:

- Cool the burn immediately with running tap water for 20 minutes. [v, vi, vii]
- Cooling is beneficial for up to three hours after injury, and should still be performed, even if there is a delay in accessing a method of cooling.[vi, viii]
- Keep the patient, especially children, as warm as possible during cooling: 'cool the burn but warm the patient'. [ix]

3. Clothing and jewellery:

- Clothing and jewellery should be removed immediately. [viii, x]
- Clothing or jewellery that is melted or firmly adherent to the wound should be left undisturbed, but this should not deter from cooling the burn wound [viii, xi]

4. Covering the wound:

- Cover the cooled burn with cling film, or where this is not available, a clean cloth or non-adherent dressing. [xi]
- Cling film should be applied loosely, and not on the face.
- Burn gel wraps may be used to provide analgesia, but only after adequate cooling has occurred as they do not actively remove heat from the wound [ii]

'Cool, Call and Cover':

1. **Cool** the burn with **running cold tap water** for **20 minutes** and **remove** all clothing and jewellery.
2. **Call** for help – 999, 111 or local GP for advice.
3. **Cover** with cling film or a sterile, non-fluffy dressing or cloth. Make sure the patient is kept warm.

Compiled by: Alice Varley, Julia Sarginson and Amber Young, July 2014

Evidence Summary

Cooling the burn wound:

Temperature: Cuttle in 2008 demonstrated the effects of cold running water on a porcine model of partial thickness burn injury. Running water of 2 or 15°C applied for 20 minutes post burn resulted in better outcomes compared to a control regarding healing and appearance at six weeks post injury. Although 2 °C provided marginally improved outcomes over 15°C, the risk of hypothermia is greater in children. [iv] Guidelines set by the Department of Health require the temperature of domestic tap water in the UK to be below 20°C, making the UK cold water supply an adequate method of cooling. [xi]

Duration and delay: Bartlett in 2008 demonstrated that applying cold running tap water to the burn for 20 minutes resulted in significantly less histological damage compared to cooling of five, ten or 30 minutes. [iv] Cuttle showed higher re-epithelialisation rates and decreased scar tissue compared to untreated controls with this duration of cooling.[vi] Immediate cooling is always recommended to best limit tissue damage and to alleviate pain [vi, vii], however, two studies have also demonstrated beneficial outcomes even when cooling was delayed by one to three hours. [vi, vii]

Clothing and jewellery:

Clothing can retain heat, particularly in hot water scalds, and so should be removed as soon as possible. [xi] Synthetic materials such as nylon can melt and adhere to the skin and should be handled by experienced personnel. Jewellery should be removed to prevent constriction around swollen limbs or digits following burn injury which could threaten vascular supply to the distal tissues. [ii]

Covering the burn wound:

Cling film provides a non-adherent, fluid resistant and transparent dressing; it reduces pain from air exposure and allows for medical assessment without its removal. [ii] If it is unavailable, any clean, sterile dressing or cloth can provide an adequate substitute. [vii] Creams, butter, ointments, oils, milk and toothpaste should not be used.[xii] Gel wraps, and burn gel products, can be used for comfort, but are not a substitute for cooling with cold running tap water. [ii]

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Appendix 4 – Burn injury agents and their definitions as used in the BaSAT and Children's Burns Research Network Database

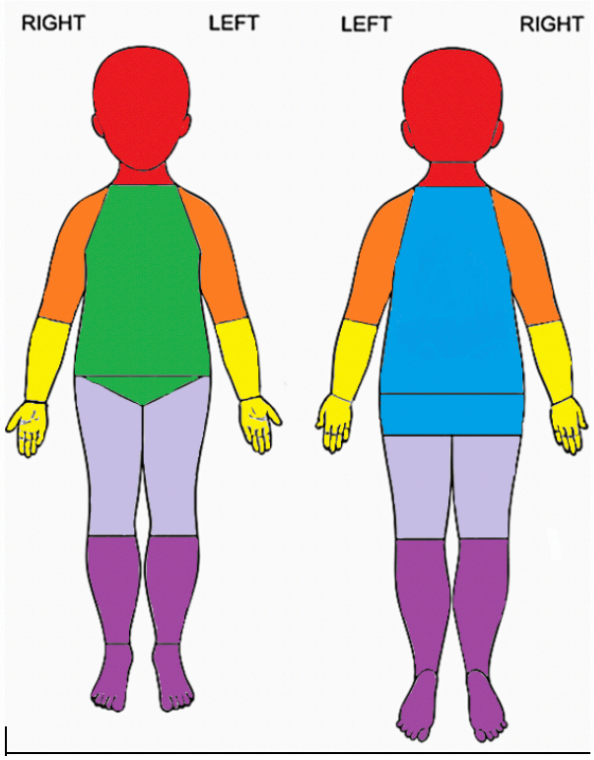
Agent	Definition
Hot Drink	All hot drinks (including but not exclusive to tea, coffee and hot chocolate)
Hot Food	All hot foods (including liquid food types such as soup and fats/oils)
Hot Water	All hot water (including steam)
Cooking Appliances/Oven	All cooking appliances (including but not exclusive to pots, pans and baking tins) and any area of the oven
Hair Styling Devices	All heated hair styling devices (including but not exclusive to straighteners and curling wands)
Iron	All household ironing appliances
Radiator	All household radiator appliances
Aerosol	All aerosol spray
Sun	All sunburn
Fireworks	All firework and firework-type agents (including but not exclusive to fireworks rockets, firework shells and hand-held sparklers)
Vehicle Exhausts	All vehicle exhausts (including but not exclusive to motorcars and motorcycles)
Petrol	All petrol substances
Outdoor Heat/Fire Source	All outdoor heat fire sources (including but not exclusive to BBQ/grills, chimeneas, fire pits and bonfires)
Other	Plant substance, anti-bacterial cleaner, treadmill, black plastic, light bulb, bunsen burner, burning chair, burning paper, burning plastic, candle, candle lighter, cigarette lighter, car cigarette lighter, carpet, chemical, chemistry metal tripod, chemical, chimney, cosmetic oil, electric cable, fire surround, light fitting, electrical stimulation pads, peg, fire/flame, fire door, floor cleaner, gas fire, gas lamp, glue, glue gun, hair removal products, towel rail, hogweed, hydrochloric acid, handheld electrical device charger, metal bin, nail glue, nitro fluid, rope, oven cleaner, oil burner, squaric acid, playground slide, sulphuric acid, test tube, toilet cleaner, towel rail, trampoline, verruca/wart cream, electrical appliance power button
Missing	Where no answer was provided under the agent variable and no relevant detail were

	provided in the open text injury explanation

Appendix 5 – Burn injury mechanisms and their definition as used in the BaSAT and Children's Burns Research Network Database

Mechanism	Definition
Immersion	Where the body site was immersed into the agent
Touch	Where the body site came into contact/touched the agent
Spill	Where the agent was spilt onto the body site
Fell/Ran into	Where the individual fall/ran into the agent
Pull down	When the agent was pulled in a downward motion causing the agent to make contact with the body site
Splash	When the agent splashed causing contact of drops with the body site
Exposure to sun	When the body site was exposed directly to the sun
Spray	When the agent was sprayed directly on to the body site
Explosion	When the agent exploded
Other	Steam, caught fire, drank, dropped, stepped on, walked into, washing, thrown at/on
Not known	When the mechanism of injury was unknown to the patient and/or care-providers
Missing	Where no answer were provided under the mechanism variable and no relevant detail were provided in the open text injury explanation

Appendix 6 – Body Map as used in BaSAT and categorisation of body site effected by burn injury in Children's Burns Research Network Database



Area 1 – **Head, neck and face**

Area 2 – **Shoulder and upper arm**

Area 3 – **Lower arm and hand**

Area 4 – **Torso**

Area 5 – **Back**

Area 6 – **Upper leg and knee**

Area 7 – **Lower leg and foot**

Appendix 7 – BaSAT v4.0 data collection tool for the Children's Burns Research Network Database

Children's Burns Research Centre: Burns & Scalds Assessment Tool

PLEASE COMPLETE THE WHOLE FORM FOR **ALL** CHILDREN **0-16th** Birthday, PRESENTING WITH A **BURN OR SCALD INJURY**.

Please complete all sections, ticking all answers which apply.

Centre	ID No. *(allocated by research team)*
Cardiff & Vale	
North Bristol Trust	
University Hospital Bristol	

Assessment:

Date: ____ /____ /____ Time: ____ : ____ (24hrs). **Person completing this form:** Nurse SHO REG ENP CONS ANP

Who is accompanying the child?

Mum ☐ Dad ☐ Peer ☐ Other Adult ☐

Section 1: History of injury

1.1: Type of Injury

Scald	☐	Flame	☐	Electrical	☐
Contact burn	☐	Friction	☐	Chemical	☐
Radiation	☐	Other	☐	*Details if other:*	

Date & time of injury:

Date: ____ /____ /____ : ____ : ____ (24hrs).

Location:

Home ☐ Other ☐ *Details if other:*

1.2: First aid given by Parent/Carer? Yes ☐ No ☐

If yes Cold water ☐ Other ☐

If cold water was it:

Immersion ☐ Under running tap? ☐

How long was it under water for? _____ Minutes

Other ☐ *Details if other:*

Was injury covered? Yes ☐ No ☐

If yes what with? _____

1.3: Details of Incident

Was anyone in the room/vicinity at the time? Yes ☐ No ☐

If yes who?

Parent ☐ Peer ☐ Sibling ☐

Age of Peer/sibling _____

Other Adult ☐ *(who)* _____

If yes, did they see what happened? Yes ☐ No ☐

What is the explanation for the injury?

1.4: What was the child doing at the time?

Play/Exploration	☐	Being carried/held	☐	Sitting	☐
Running	☐	Preparing food/drink	☐	Standing	☐
Other	☐	*Details if other:*			

1.5: Agent/Mechanism

Please complete all applicable

Agent		Source if scald		Where was hot item?	
Tea	☐	Kettle	☐	Kitchen surface	☐
Coffee	☐	Mug/cup	☐	Microwave	☐
Soup	☐	Pan	☐	Dining table	☐
Hot food	☐	Bath	☐	Low table	☐
Water	☐	Shower	☐	Floor	☐
Steam	☐	Tap	☐	Oven	☐
Fat/oil	☐	Other	☐	On cooker hob	☐
Oven door	☐	N/A	☐	Garden/outdoor	☐
Oven hob	☐	*Details if other:*		Other	☐
Iron	☐			N/A	☐
Radiator	☐			*Details if other:*	
Cigarette	☐				
Hair straightener	☐				
Hair tongs	☐				
Sun burn	☐				
Sun bed	☐				
Fireworks	☐				
Other	☐				
Details if other:					

Mechanism					
Pull down	☐	Spill	☐	Splash	☐
Fell/run into	☐	Touch	☐	Immersion	☐
Explosion	☐	Inflicted	☐	Stepped on	☐
Caught fire	☐	Climbed into	☐	Not known	☐
Other	☐	*Details if other:* _____			

Version 4: 26 July 2013 3/4

Section 2: Details of child & social history

2.1:

Is there any pre-injury impairment?	Yes ☐			No ☐	
Motor	☐	Behavioural	☐	Neurological	☐
Learning	☐	Hearing	☐	Vision	☐
If present please provide details below					
Stage of motor development					
Non Mobile Baby	☐	Rolling over	☐	Sitting	☐
Crawling	☐	Cruising	☐	Walking	☐

2.2:

Does child/family have a social worker?
Yes ☐ No ☐
Is there any history of any domestic abuse?
Yes ☐ No ☐
If yes to any of the above please give details below
Child in need ☐
Child Protection Plan ☐
Otherwise known to Social Services ☐
Details: _____

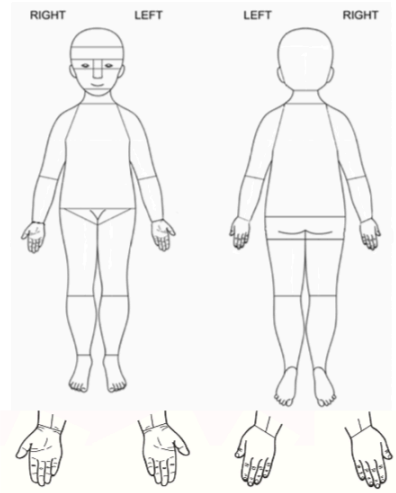
Section 3: Description of injury on examination

3.1: If scald injury, is the pattern?	
Symmetrical (both sides of body)	☐
Glove & Stocking distribution (Circumferential)	☐
Clearly defined margins	☐
Skin fold sparing	☐
3.2: If a contact burn, is the pattern?	
Margin in the shape of an implement	☐
Multiple contact burns	☐
3.3: Depth of injury	
Erythema (no blisters)	☐
Partial thickness (Epidermis/Dermis, Blisters)	☐
Full thickness (Epidermis/Dermis, Blisters)	☐
3.4: Uniformity of depth of injury	
Uniform	☐
Variable	☐
Percentage of body injured: ☐ %	

3.5: Are there any other injuries? *(do not mark on body map)*					
Yes	☐	No	☐		
Bruises	☐	Fractures	☐	Other	☐
Describe other injuries if present: _____					

3.6: Has there been a previous burn injury?
Yes ☐ No ☐
Details if yes:

3.7: Please shade the distribution of the burn



Section 4:

4.1: Screening questions					
Do you have any concerns about:					
Adult supervision?	Yes ☐	No ☐			
Late Presentation?	Yes ☐	No ☐			
If an explanation was given					
Was it consistent with the stage of development?					
Yes ☐	No ☐				
Did it fit with the pattern of burn seen?					
Yes ☐	No ☐				

4.2: Referrals and outcomes					
Was a social services referral made?	Yes ☐			No ☐	
If yes, for:					
Physical abuse	☐	Neglect	☐	Child in need	☐
Cause for concern	☐				
Any other referrals?					
None	☐	HV	☐	School nurse	☐
Midwife	☐	Hospital CP team	☐	Other	☐
Details if other:					
Outcome					
Discharged home	☐	Transfer to acute ward	☐	HDU	☐
ED review	☐	Specialist burns unit	☐	PICU	☐
Other specialist	☐	Other Hospital	☐		

Thank you for completing this form.
Instructions about where to leave this form are on the front sheet.

Appendix 8 - BaSAT v5.0 data collection tool for the Children's Burns Research Network Database

Children's Burns Research Centre: Burns & Scalds Assessment Tool

PLEASE COMPLETE FOR **ALL** CHILDREN **0-16th** Birthday, PRESENTING WITH A **BURN OR SCALD INJURY**.

*Please complete all sections, ticking **all** answers which apply.*

Patient Details (or Addressograph):

Name:

Hospital or NHS Number:

Date of Birth:

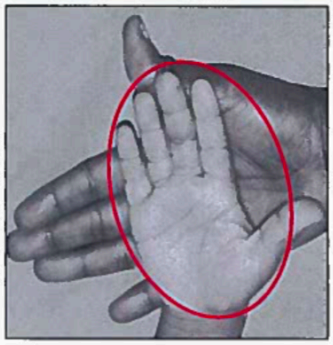
Gender:

Post code:

Version 5 – *09 October 2014*

Some information to help with the completion of this form

A) Assessing the Total Body Surface Area (TBSA) affected by the burn injury:



1% Palm Rule

Look at the PATIENTS palm - the area covered by the palm and fingers together measures approximately 1% of the body surface area.

Look at the BURN. How many of the PATIENTS full palm & finger area do you think would fit within the burn area? This is your estimation of burn size.

B) Mandatory fields upon completion of this form:

- **Age of child** *(header)*
- **Agent & Mechanism** *(section 1.5)*
- **Body map - Distribution** *(section 3.1)*
- **Pattern of injury** *(section 3.2)*
- **Depth of injury** *(section 3.3)*
- **Concerns - Supervision & Late presentation** *(section 4.1)*
- **Explanation** *(section 4.2)*
- **Social Services Involvement** *(section 4.3)*
- **Social Services referral** *(section 4.4)*

Version 5 – *09 October 2014*

Children's Burns Research Centre: Burns & Scalds Assessment Tool

For **ALL** children **0-16th birthday**, presenting with a burn or scald injury, the **WHOLE** form **MUST** be completed ticking **ALL** answers which apply in **EACH** section.

Centre	ID no. *(allocated by research team)*
Cardiff & Vale	
North Bristol Trust	
University Hospital Bristol	

Person completing this form: ☐ Research Nurse ☐ Nurse ☐ SHO ☐ REG ☐ ENP ☐ CONS ☐ ANP

Who is accompanying the child? ☐ Mum ☐ Dad ☐ Grandparent ☐ Unaccompanied ☐ Other: _____

Assessment undertaken: Date: ___/___/___ *(dd/mm/yyyy)* Time: ___:___ *(24 hrs)*

Injury occurred: Date: ___/___/___ *(dd/mm/yyyy)* Time: ___:___ *(24 hrs)*

Details of child: Gender: _____ *Age: _____ *(please record age in months if child ≤ 2 years)*

Section 1: History of injury

1.1. Type of Injury

☐ Scald ☐ Sunburn
☐ Contact burn ☐ Flame
☐ Electrical
☐ Other: _____

1.2. Location

☐ Home ☐ Café/restaurant
☐ School
☐ Other: _____

1.3. Details of Incident

Was anyone in the room/vicinity at the time? ☐ Yes ☐ No

If yes, who?
☐ Parent ☐ Sibling
☐ Grandparent ☐ Peer
☐ Other: _____

If yes, did they see what happened? ☐ Yes ☐ No

What is the explanation for the injury?

_____
_____
_____
_____
_____

1.4. In which position was the child just before the incident?

☐ Running/walking ☐ Lying down
☐ Standing ☐ Being carried/held
☐ Sitting
☐ Other: _____

1.5. Agent/Mechanism *(please complete all applicable)*

***Agent**
☐ Hot drink: _____ ☐ Oven hob ☐ Iron
☐ Hot food: _____ ☐ Oven door ☐ Radiator
☐ Hot water ☐ Hair tongs/ straightener ☐ BBQ grill
☐ Fat/oil ☐ Sun
☐ Other: _____ ☐ N/K

Source if scald
☐ Mug/cup ☐ Bowl ☐ Tap
☐ Kettle ☐ Pan ☐ Bath
☐ Other: _____ ☐ N/K

Location of hot item
☐ Floor
☐ Kitchen surface ☐ Low table ☐ Oven
☐ On cooker hob ☐ Dining table ☐ Garden/outdoor
☐ Other: _____ ☐ N/K

Mechanism
☐ Immersion
☐ Touch ☐ Spill ☐ Child fell/ran into
☐ Pull down ☐ Splash ☐ Exposure to sun
☐ Other: _____ ☐ N/K

1.6. First aid *(including inappropriate first aid)*

Was first aid given by parent/carer? ☐ Yes ☐ No

If yes, was it:
☐ Cold water
☐ Other: _____

If cold water:
a) How was the water applied?
☐ Tap/shower *(running water)* ☐ Put into water *(immersion)*

b) How long was water applied for? _____ *(min)*

Was the burn covered? ☐ Yes ☐ No

If yes, what with: _____

Version 5: 17 November 2014 1/3

Section 2: Details of child

2.1. Is there any developmental impairment?
(please tick as many as apply) ☐ N/A

☐ Motor	☐ Neurological	☐ Hearing
☐ Behavioural	☐ Learning	☐ Vision
☐ Other:		

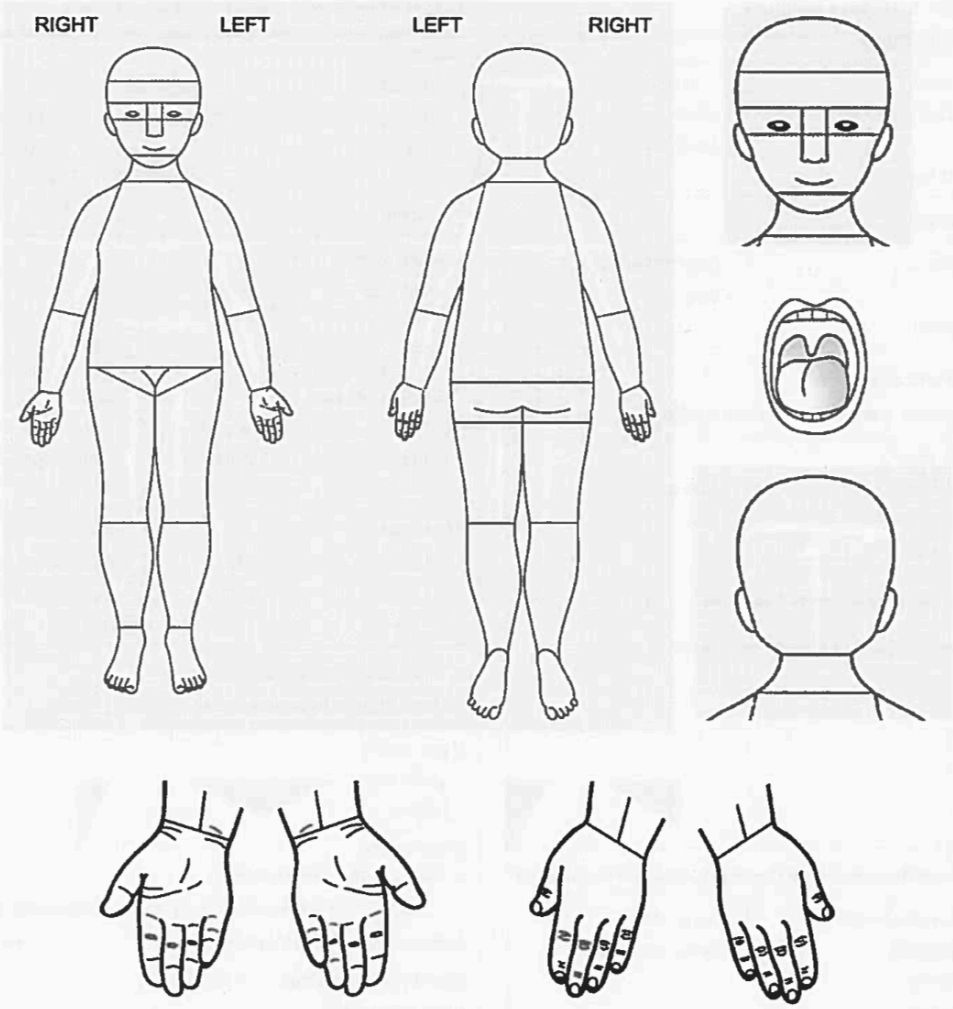
2.2. Current 'best' stage of motor development
*(please complete for **children <3 years**)* ☐ N/A

☐ Non-mobile baby	☐ Crawling
☐ Baby able to roll over	☐ Cruising
☐ Sitting	☐ Walking

Section 3: Characteristics of injury on examination

***3.1. Body map**

Please shade the distribution of the burn: ☐ N/A - no visible injury



Version 5: 17 November 2014 2/3

***3.2. Pattern of injury** ☐ N/A

(please tick as many as apply)

- ☐ Symmetrical *(both sides of body)*
- ☐ Glove/stocking distribution *(circumferential)*
- ☐ Clearly defined margins
- ☐ Skin fold sparing
- ☐ Margin in the shape of an implement
- ☐ Multiple contact burns *(more than one)*

***3.3. Depth of injury** ☐ N/A

(please tick as many as apply)

- ☐ Erythema/redness
- ☐ Blisters, not burst
- ☐ Broken skin, wet, pink
- ☐ Broken skin, dry, white or charred

3.4. TBSA ☐ N/A

(if TBSA>1% consider referral to Specialist Burns Unit, School Nurse, Health Visitor)

Percentage of body injured:

☐ ≤1% ☐ 2-9% ☐ 10-14% ☐ ≥15%

3.5. Any other injuries?

☐ Yes ☐ No

Details if yes: _____

3.6. Was there any previous ED attendance for a burn injury?

☐ Yes ☐ No

Details if yes: _____

Section 4: Screening, Referrals & Outcomes

*** 4.1. Social Services (SS) involvement**

Does the child/family have a social worker (SW) now?

☐ Yes ☐ No

Did the child/family have a SW or any SS involvement in the past?

☐ Yes ☐ No

Is there any domestic violence in the home?

☐ Yes ☐ No *(A proposed way to ask this question is **"Do you feel safe at home?"** – Only ask this question if you can talk to one of the parents independently.)*

***4.2. Do you have any concerns about...**

Appropriate adult supervision?

☐ Yes ☐ No

Late presentation?

☐ Yes ☐ No

If yes, is there a valid reason for delay?
(previous GP/ED attendance, etc.)

_____

_____

***4.3. If an explanation was given...**

Was it consistent with the stage of development?

☐ Yes ☐ No

Did it fit with the burn pattern seen?

☐ Yes ☐ No

4.4. Referrals and outcomes *(please tick as many as apply)*

***Was a Child Protection referral made?**

- ☐ None
- ☐ Social Services ☐ Hospital safeguarding team

Were any other referrals made?

- ☐ None
- ☐ School Nurse ☐ Health Visitor
- ☐ Other: _____

Outcome

- ☐ Discharged home ☐ GP/ Practice Nurse
- ☐ ED review ☐ Specialist burns unit
- ☐ Transfer to acute ward
- ☐ Other: _____

Overall additional comments:

_____

_____

_____

_____

_____

_____

_____

_____

Appendix 9 - BaSAT v6.0 & v7.0 data collection tool for the Children's Burns Research Network Database

Burns & Scalds Assessment Template. (BASAT)

Please complete for ALL children 0-16th birthday presenting with a BURN or SCALD injury.
Please complete ALL sections, ticking ALL answers that apply

Patient Details (or addressograph)

Hospital or **NHS** number:

Name: Date of Birth:

Gender: Post code:

Ethnicity:

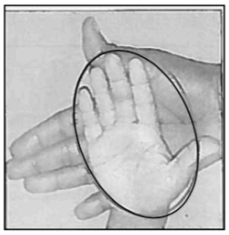
White		**Asian**		**Other**	
	British		Indian		Arab
	Irish		Pakistani		Any other back ground
	Gypsy or Irish Traveller		Bangladeshi		
	Any other white back ground		Chinese		
Mixed			Any other Asian back ground		
	White & Black Caribbean	**Black**			
	White & Black African		African		
	White & Asian		Caribbean		
	Any other mixed back ground		Any other Black back ground		

Version 7: 07/03/2016

Information to help with the completion of this form.

A. Assessing the Total body surface area (TBSA) affected.

1% Palm rule.



Look at the patients palm—the area that can be covered by their palm and fingers together measure approximately 1% TBSA.

B. Mandatory fields.

- Age of the child (header)
- Agent & Mechanism (1.5)
- Body map—distribution (3.1)
- Pattern of injury (3.2)
- Depth of injury (3.3)
- Concerns—Supervision & late presentation (4.1)
- Explanation (4.2)
- Social services involvement (4.3)
- Social services referral (4.4)

Name:	Centre	
Hospital No.	ID. No.	
DOB:		

Clinician completing form:

Person completing this form: ☐ Research Nurse ☐ Nurse ☐ SHO ☐ REG ☐ ENP ☐ CONS ☐ ANP

Who is accompanying the child? ☐ Mum ☐ Dad ☐ Grandparent ☐ Unaccompanied ☐ Other:

Assessment undertaken: Date: / / *(dd/mm/yy)* Time: : *(24hr)*

Injury Occurred: Date: / / *(dd/mm/yy)* Time: : *(24hr)*

Details of child: Gender: *Age *(record in mths if child < 2)*

Section 1: History of Injury

1.1 Type of Injury

☐ Scald ☐ Sunburn
☐ Contact Burn ☐ Flame
☐ Electrical ☐ Other:

1.2 Location

☐ Home ☐ Café/Restaurant
☐ School ☐ Other:

1.3 Details of Incident

Was anyone in the room/vicinity at the time?

☐ Yes ☐ No

If yes, who?

☐ Parent ☐ Grandparent ☐ Peer

☐ Sibling ☐ Other:

Did they see what happened? ☐ Yes ☐ No

What is the explanation for the injury?

1.4 What was the child doing just before the incident?

☐ Running/Walking ☐ Being Carried/ held
☐ Lying Down ☐ Sitting ☐ Standing
☐ N/K ☐ Other:

Version 7: 07/03/2016

1.5 Agent/Mechanism *(please complete all applicable)*

*Agent

☐ Hot Drink ☐ Oven Hob ☐ Radiator ☐ BBQ ☐ Iron
☐ Hot Food ☐ Oven Door ☐ Hair Tongs/ Straighteners
☐ Water ☐ Fat/Oil ☐ Sun ☐ N/K
☐ Other:

Source if scald

☐ Mug/cup ☐ Bowl ☐ Tap ☐ Bath ☐ Shower
☐ Kettle ☐ Pan ☐ N/K ☐ Other:

Location of hot item

☐ Kitchen surface ☐ Low table ☐ Floor ☐ On cooker hob
☐ Dining table ☐ Oven ☐ Garden/outside
☐ N/K ☐ Other:

Mechanism

☐ Touch ☐ Pull down ☐ Immersion ☐ Spill
☐ Fell/ran into ☐ Splash ☐ Exposure to sun
☐ N/K ☐ Other:

1.6 First Aid *(including inappropriate first aid)*

Was First Aid given by Parent/carer? ☐ Yes ☐ No

If yes was it? *(tick all that apply)*

☐ Cold Water ☐ Sudocrem ☐ Butter
☐ Wet compress ☐ Talcum Powder ☐ Honey
☐ Ice ☐ Toothpaste ☐ Tumeric
☐ Other "cooling" agent *(e.g frozen peas)* ☐ Other cream/gel/ointment *(specify)* ☐ Egg
☐ Other *(specify)*

If cold water how was it applied?

☐ Tap/shower *(running water)* ☐ Put into water *(immersion)*

How long was water applied for? *(mins)*

Was the burn covered? ☐ Yes ☐ No

If yes, what with?

Was Analgesia administered by the parent/carer prior to arrival at ED?

☐ None ☐ Paracetamol ☐ Ibuprofen ☐ Other (specify)

Name: **Hosp. No.** **DOB:**

Section 2: Details of child

2.1. Is there any developmental impairment?

(Please tick all that apply) ☐ **N/A**

☐ Motor ☐ Neurological ☐ Hearing ☐ Behavioural ☐ Learning ☐ Vision ☐ Other:

2.2. Current 'best' stage of development.

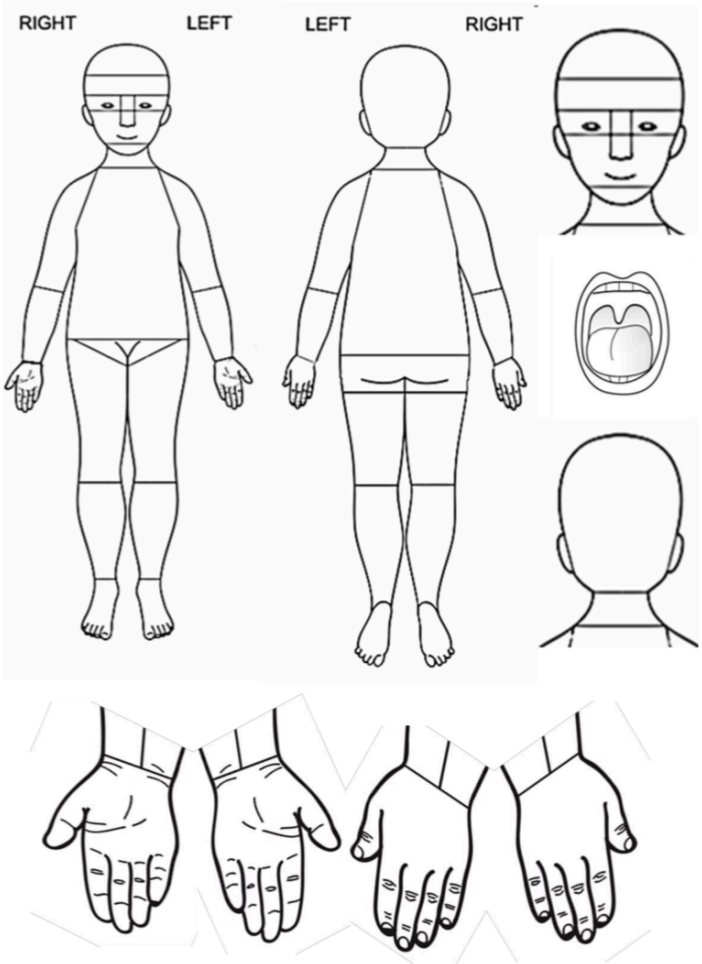
(please complete for children < 3 years & if yes to Q 2,1) ☐ N/A

☐ Non mobile Baby ☐ Baby able to roll over ☐ Sitting ☐ Crawling ☐ Cruising ☐ Walking

---

Section 3: Characteristics of injury on examination.

3.1 Body map—please shade distribution of injury. ☐ **N/A—no visible injury**



Version 7: 07/03/2016

Name: **Hosp. No.** **DOB:**

***3.2 Pattern of injury** *(tick all that apply)* **N/A**

- ☐ **Symmetrical *(both sides of the body)***
- ☐ **Glove/stocking distribution**
- ☐ **Clearly defined margins**
- ☐ **Skin fold sparing**
- ☐ **Margin in shape of an implement**
- ☐ **Multiple contact burns (more than one)**

3.4 TBSA **N/A**

(if /TBSA > 1% consider referral to specialist Burns Unit, School Nurse, Health Visitor)

Percentage of body injured:

☐ **≤ 1%** ☐ **2-9%** ☐ **10-14%** ☐ **≥ 15%**

3.5 Any other injuries on examination?

☐ **Yes** ☐ **No**

Details if yes:

***3.3 Depth of Injury** *(tick all that apply)* **N/A**

☐ **Erythema/redness** ☐ **Blisters, not burst**

☐ **Wet, pink** ☐ **Dry, white or charred**

3.6 Have there been any previous ED attendance for:

☐ **Burn Injury** ☐ **Other Injury**

Details if yes

Section 4: Screening, Referrals & Outcomes

*** 4.1 Social Service** *(SS)* **Involvement**

Does the Child/Family have a Social worker *(SW)* **Now?** ☐ **Yes** ☐ **No**

Did the Child/Family have a SW or any SS involvement in the past? ☐ **Yes** ☐ **No**

Is there any Domestic Violence in the Home ☐ **Yes** ☐ **No**

(A proposed way to ask this question is " Do you feel safe at home?" - only ask this question if you can talk to the parent on their own)

***4.2 Do you have…….**

Concerns about Appropriate Adult Supervision? ☐ **Yes** ☐ **No**

Concerns about Late Presentation? ☐ **Yes** ☐ **No** *(if yes is there a valid reason for delay? E.g. Previous GP/Pharmacist/ED attendance etc.?)*

***4.3 if an explanation was given….**

Was it consistent with stage of development? ☐ **Yes** ☐ **No** **Did it fit with the pattern of injury seen?** ☐ **Yes** ☐ **No**

*** 4.4 Referrals & Outcomes** *(tick as many as apply)*

Was a Child Protection referral made?	Were any other referrals made?	Outcome?
☐ None	☐ None	☐ Discharged Home
☐ Social Services	☐ Health Visitor	☐ ED review
☐ Hospital Safeguarding Team	☐ School Nurse	☐ GP/Practice Nurse
	☐ Other	☐ Specialist Burns Unit
		☐ Transfer to Acute ward
		☐ Other

Overall Additional comments:

Version 7: 07/03/2016

Appendix 10 – Amalgamated variables for Chi-square analysis for Children's Burns Research Network Database

Variable	Categories included in analysis	Category amalgamations
Agent	Hot Drink	
	Hot Food	
	Hot Water	
	Cooking Appliances/Oven	
	Hair Styling Devices	
	Other	Other, Missing, Aerosol, Outdoor Heat Sources, Iron, Radiator, Fireworks, Vehicle Exhausts and Petrol
Mechanism	Touch	
	Spill	
	Fell/Ran Into	
	Splash	
	Exposure to Sun	
	Explosion	
	Other	Other, Missing, Immersion, Pull Down, Not Known and Spray

Appendix 11 – Number of contributed cases by site from the Children's Burns Research Network Database 2013 – 2017

Centre	Date of data collection	Ascertainment Rate	Number of cases contributed to dataset (n = 1084)
Cardiff	January 2013 – April 2017	90 – 100%	259 (23.9%)
Bristol	June 2013 – April 2014 [Break] June 2014 – April 2017	90 – 100%	311 (28.7%)
North Manchester	January 2015 – April 2017	60 – 70%*	294 (27.1%)
Wrexham	March 2016 – April 2017	45%*	11 (1.0%)
Swansea	April 2016 – April 2017	80 – 90%*	137 (12.6%)
Birmingham	October 2016 – April 2017	80 – 90%	72 (6.6%)

*Indicates where data were unavailable and approximate figures have been provided following discussion with the principle investigator of the site

Appendix 12 – Burn injuries by years of age and gender for the Children's Burns Research Network Database

Age at time of injury (years)	Gender of child		Total
	Male	Female	
5	66 (50.4%)	65 (49.6%)	131 (12.1%) (95% CI 10.3% to 14.2%)
6	56 (49.6%)	57 (50.4%)	113 (10.4%) (95% CI 8.7% to 12.4%)
7	40 (44.0%)	51 (56.0%)	91 (8.4%) (95% CI 6.9% to 10.2%)
8	55 (56.1%)	43 (43.9%)	98 (9.0%) (95% CI 7.5% to 10.9%)
9	43 (49.4%)	44 (50.6%)	87 (8.0%) (95% CI 6.6% to 9.8%)
10	42 (45.2%)	51 (54.8%)	93 (8.6%) (95% CI 7.1% to 10.4%)
11	62 (50.0%)	62 (50.0%)	124 (11.4%) (95% CI 9.7% to 13.5%)
12	49 (55.1%)	40 (44.9%)	89 (8.2%) (95% CI 6.7% to 10.0%)
13	39 (43.3%)	51 (56.7%)	90 (8.3%) (95% CI 6.8% to 10.1%)
14	37 (46.3%)	43 (53.7%)	80 (7.4%) (95% CI 6.0% to 9.1%)
15	40 (45.5%)	48 (54.5%)	88 (8.1%) (95% CI 6.6% to 9.9%)
Total	529 (48.8%)	555 (51.2%)	1084

Appendix 13 – Number and percentage of impairments in patients from the Children's Burns Research Network Database by age group (years)

Number of Impairments	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
1	16 (4.8%)	9 (3.2%)	10 (3.3%)	8 (4.8%)	**43 (68.3%)**
2	5 (1.5%)	2 (0.7%)	3 (1.0%)	1 (0.6%)	**11 (17.5%)**
3	0	2 (0.7%)	3 (1.0%)	1 (0.6%)	**6 (9.5%)**
4	0	1 (0.4%)	1 (1.0%)	0	**2 (3.2%)**
5	0	1 (0.4%)	0	0	**1 (1.6%)**
Total	**21 (6.3%)**	**15 (5.4%)**	**17 (5.6%)**	**10 (6.0%)**	**63**

Appendix 14 - Type of impairments in patients from the Children's Burns Research Network Database by age group (years)

Impairment	Age Group (years)				Total
	5 – 7	8 – 10	11 – 13	14 - 15	
Motor	**4**	**7**	**4**	**0**	**15 (15.6%)**
Behavioural	**9**	**9**	**7**	**5**	**30 (31.3%)**
Neurological	**2**	**3**	**5**	**1**	**11 (11.5%)**
Learning	**6**	**9**	**7**	**5**	**27 (28.1%)**
Hearing	**3**	**1**	**3**	**2**	**9 (9.4%)**
Vision	**2**	**2**	**0**	**0**	**4 (4.2%)**
Total	**26**	**31**	**26**	**13**	**96**

Appendix 15 – Number of body sites affected by burn injury by age group (years) in the Children's Research Networks Database

Number of Body Sites Affected	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
0	26 (7.8%)	16 (5.8%)	17 (5.6%)	12 (7.1%)	**71 (6.5%)**
1	249 (74.3%)	212 (76.3%)	227 (74.9%)	127 (75.6%)	**815 (75.2%)**
2	46 (13.7%)	34 (12.2%)	42 (13.9%)	20 (11.9%)	**142 (13.1%)**
3	11 (3.3%)	10 (3.6%)	16 (5.3%)	8 (4.85)	**45 (4.2%)**
4	2 (0.6%)	4 (1.4%)	0	1 (0.6%)	**7 (0.6%)**
5	0	2 (0.7%)	0	0	**2 (0.2%)**
6	1 (0.3%)	0	0	0	**1 (0.1%)**
7	0	0	1 (0.3%)	0	**1 (0.1%)**
Total	**335**	**278**	**303**	**168**	**1084**

Appendix 16 – Body site affected by burn injury by age groups (years) in the Children's Burns Research Network Database

Body Site Affected	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
Head, Neck and Face	21 (19.8%)	35 (33.0%)	28 (26.4%)	22 (20.8%)	**106 (8.2%)**
Shoulder and Upper Arm	37 (31.9%)	30 (25.9%)	36 (31.0%)	13 (11.2%)	**116 (9.0%)**
Lower Arm and Hand	168 (34.4%)	108 (22.1%)	139 (28.4%)	83 (17.0%)	**498 (38.8%)**
Torso	39 (24.8%)	52 (33.1%)	49 (31.2%)	17 (10.8%)	**157 (12.2%)**
Back	24 (31.6%)	19 (25.0%)	25 (32.9%)	8 (10.5%)	**76 (5.9%)**
Upper Leg and Knee	42 (25.3%)	48 (28.9%)	49 (29.5%)	27 (16.3%)	**166 (12.9%)**
Lower Leg and Foot	57 (34.3%)	44 (26.5%)	40 (24.1%)	25 (15.1%)	**166 (12.9%)**
Total	**388**	**336**	**366**	**195**	**1285**

Appendix 17 – Total Body Surface Area affected by burn injury by years of age and age group in the Children's Burns Research Network Database

Age (years)	≤ 1%	2 – 9%	10 – 14%	≥ 15%	N/A	Missing	Total
5	89 (67.9%)	24 (18.3%)	0	0	2 (1.5%)	16 (12.2%)	131
6	64 (56.6%)	16 (14.2%)	2 (1.8%)	1 (0.9%)	6 (5.3%)	24 (21.2%)	113
7	48 (52.7%)	17 (18.7%)	1 (1.1%)	0	6 (6.6%)	19 (20.9%)	91
8	60 (61.2%)	15 (15.3%)	1 (1.0%)	1 (1.0%)	4 (4.1%)	17 (17.3%)	98
9	47 (54.0%)	12 (13.8%)	0	1 (1.1%)	6 (6.9%)	21 (24.1%)	87
10	46 (49.5%)	20 (21.5%)	0	0	5 (5.4%)	22 (23.7%)	93
11	68 (54.8%)	23 (18.5%)	2 (1.6%)	0	8 (6.5%)	23 (18.5%)	124
12	41 (46.1%)	22 (24.7%)	1 (1.1%)	1 (1.1%)	5 (5.6%)	19 (21.3%)	89
13	55 (61.1%)	12 (13.3%)	0	0	1 (1.1%)	22 (24.4%)	90
14	47 (58.8%)	10 (12.5%)	0	0	1 (1.3%)	22 (27.5%)	80
15	54 (61.4%)	13 (14.8%)	1 (1.1%)	1 (1.1%)	2 (2.3%)	17 (19.3%)	88
Total	619 (57.1%)	184 (17.0%)	8 (0.7%)	5 (0.5%)	46 (4.2%)	222 (20.5%)	1084
5 – 7	201 (60.0%)	57 (17.0%)	3 (0.9%)	1 (0.3%)	14 (4.2%)	59 (17.6%)	335
8 – 10	153 (55.0%)	47 (16.9%)	1 (0.4%)	2 (0.7%)	15 (5.4%)	60 (21.6%)	278
11 – 13	164 (54.1%)	57 (18.8%)	3 (1.0%)	1 (0.3%)	14 (4.6%)	64 (21.1%)	303
14 – 15	101 (60.1%)	23 (13.7%)	1 (0.6%)	1 (0.6%)	3 (1.8%)	39 (23.2%)	168
Total	619 (57.1%)	184 (17.0%)	8 (0.7%)	5 (0.5%)	46 (4.2%)	222 (20.5%)	1084

Appendix 18 – Burn injury depth by age group (years) in the Children's Burns Research Network Database

Injury Depth	Age Group (years)				Total
	5 – 7 (n = 335)	**8 – 10 (n = 278)**	**11 – 13 (n = 303)**	**14 – 15 (n = 168)**	
Depth 1	48 (14.3%)	43 (15.5%)	51 (16.8%)	29 (17.3%)	171 (15.8%)
Depth 2	163 (48.7%)	136 (48.9%)	143 (47.2%)	77 (45.8%)	519 (47.9%)
Depth 3	82 (24.5%)	58 (20.9%)	75 (24.8%)	33 (19.6%)	248 (22.9%)
Depth 4	18 (5.4%)	20 (7.2%)	16 (5.3%)	16 (9.5%)	70 (6.5%)
Missing	24 (7.2%)	21 (7.6%)	18 (5.9%)	13 (7.7%)	76 (7.0%)
Total	335	278	303	168	1084

Appendix 19 – Age group (years) comparisons in reference to 5 – 7 age group for injury type, agent, mechanism, total body surface area, injury depth, injury location, time of day, day of the week, weekday vs weekend, season and first-aid delivery (Chi-squared and Fisher Exact test results) for Children's Burns Research Network Database

Variable	Age Group Comparisons (years)		
	5 – 7 / 8 – 10 years	5 – 7 / 11 – 13 years	5 – 7 / 14 – 15 years
Injury Type	*p<.001	*p<.001	*p<.001
Agent	p = .001 df = 6 X^2 = 23.901 Cramers V = .197 Weak	p<.001 df = 6 X^2 = 28.560 Cramer's V = .212 Moderate	p =.004 df = 6 X^2 = 18.934 Cramer's V = .194 Weak
Mechanism	*p = .001 df = 6 X^2 = 22.475 Cramers V = .191 Weak	*p<.001 df = 6 X^2 = 39.286 Cramer's V = .248 Moderate	*p<.001 df = 6 X^2 = 45.306 Cramer's V = .300 Moderate
TBSA	p = .626	p = .786	p = .391
Injury Depth	p = .764 df = 4 X^2 = 1.848 Cramer's V = 0.55	p = .897 df = 4 X^2 = 1.083 Cramer's V = .041	p = .302 df = 4 X^2 = 4.862 Cramer's V = .098
Injury Location	p = 1.40 df = 5 X^2 = 8.316 Cramer's V = .116	*p = <.001 df = 5 X^2 = 30.779 Cramer's V = .220 Moderate	*p = <.001 df = 5 X^2 = 37.715 Cramer's V = .274 Moderate
Time of Day	p = .354 df = 5 X^2 = 5.533 Cramers V = .103	p = .611 df = 5 X^2 = 3.583 Cramer's V =0.81	*p = .027 df = 5 X^2 = 12.647 Cramer's V = .171 Weak
Day of the Week	*p = .038 df = 7 X^2 = 14.833 Cramer's V = .156 Weak	*p = .023 df = 6 X^2 = 14.665 Cramer's V = .152 Weak	p = .284 df = 6 X^2 = 7.412 Cramer's V = .122
Weekday vs Weekend	p = .142	p = .145	p = .234
Season	p = .248 df = 3 X^2 = 4.130 Cramer's V = 0.83	p = .147 df = 3 X^2 = 5.367 Cramer's V = .092	*p = .019 df = 3 X^2 = 9.928 Cramer's V = .141 Weak
First-Aid Delivery	p = .065 df = 1 3.412	p = .613 df = 1 .256	p = .317 df = 1 .999

Cramer's V = .081	Cramer's V = .022	Cramer's V = .049

*Indicates a significant result

Appendix 20 – Type of injury by year of age in Children's Burns Research Network Database

Injury Type	Age (years)											Total Injury Type
	5	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
Scald	51 (38.9%) (95% CI 31.0% to 47.5%)	49 (43.4%) (95% CI 34.6% to 52.6%)	48 (52.7%) (95% CI 42.6% to 62.7%)	57 (58.2%) (95% CI 48.3% to 67.4%)	51 (58.6%) (95% CI 48.1 to 68.4%)	58 (62.4%) (95% CI 52.2% to 71.5%)	66 (52.3%) (95% CI 44.5% to 61.8%)	42 (47.2%) (95% CI 37.2% to 57.5%)	49 (54.4%) (95% CI 44.2% to 64.3%)	23 (28.7%) (95% CI 20.0% to 39.5%)	38 (43.2%) (95% CI 33.3% to 53.6%)	**532 (49.1%) (95% CI 46.1% to 52.1%)**
Flame	1 (0.8%) (95% CI 0.1% to 4.2%)	2 (1.8%) (95% CI 0.5% to 6.2%)	3 (3.3%) (95% CI 1.1% to 9.3%)	4 (4.1%) (95% CI 1.6% to 10.0%)	2 (2.3%) (95% CI 0.6% to 8.0%)	4 (4.3%) (95% CI 1.7% to 10.5%)	9 (7.3%) 995% CI 3.9% to 13.2%)	8 (9.0%) (95% CI 4.6% to 16.8%)	5 (5.6%) (95% CI 2.4% to 12.4%)	6 (7.5%) (95% CI 3.5% to 15.4%)	10 (11.4%) (95% CI 6.3% to 19.7%)	**54 (5.0%) (95% CI 3.8% to 6.4%)**
Electrical	6 (4.6%) (95% CI 2.1% to 9.6%)	1 (0.9%) (95% CI 0.2% to 4.8%)	0	0	2 (2.3%) (95% CI 0.6% to 8.0%)	1 (1.1%) (95% CI 0.2% to 5.9%)	0	0	0	3 (3.8%) (95% CI 1.3% to 10.5%)	1 (1.1%) (95% CI 0.2% to 6.2%)	**14 (1.3%) (95% CI 0.8% to 2.2%)**
Contact	65 (49.6%) (95% CI 41.2% to 58.1%)	54 (47.8%) (95% CI 38.8% to 56.9%)	34 (37.4%) (95% CI 28.1% to 47.6%)	31 (31.6%) (95% CI 23.3% to 41.4%)	26 (29.9%) (95% CI 21.3% to 40.2%)	24 (25.8%) (95% CI 18.0% to 35.5%)	35 (28.2%) (95% CI 21.1% to 36.7%)	22 (24.7%) (95% CI 16.9% to 34.6%)	26 (28.9%) (95% CI 20.5% to 39.0%)	28 (35.0%) (95% CI 25.5% to 45.9%)	27 (30.7%) (95% CI 22.0% to 41.0%)	**372 (34.3%) (95% CI 31.6% to 37.2%)**
Friction	2 (1.5%) (95% CI 0.4% to 5.4%)	3 (2.7%) (95% CI 0.9% to 7.5%)	1 (1.1%) (95% CI 0.2% to 6.0%)	0	0	1 (1.1%) (95% CI 0.2% to 5.9%)	1 (0.8%) (95% CI 0.1% to 4.4%)	1 (1.1%) (95% CI 0.2% to 6.1%)	0	1 (1.3%) (95% CI 0.2% to 6.8%)	0	**10 (0.9%) (95% CI 0.5% to 1.7%)**

Chemical	2 (1.5%) (95% CI 0.4% to 5.4%)	0	2 (2.2%) (95% CI 0.6% to 7.7%)	0	1 (1.1%) (95% CI 0.2% to 6.2%)	2 (2.2%) (95% CI 0.6% to 7.5%)	7 (5.6%) (95% CI 2.8% to 11.2%)	5 (5.6%) (95% CI 2.4% to 12.5%)	6 (6.7%) (95% CI 3.1% to 13.8%)	10 (12.5%) (95% CI 6.9% to 2.2%)	2 (2.3%) (95% CI 0.6% to 7.9%)	**37 (3.4%) (95% CI 2.5% to 4.7%)**
Radiation/Sunburn	4 (3.1%) (95% CI 1.2% to 7.6%)	4 (3.5%) (95% CI 1.4% to 8.8%)	3 (3.3%) (95% CI 1.1% to 9.3%)	6 (6.1%) (95% CI 2.8% to 12.7%)	4 (4.6%) (95% CI 1.8% to 11.2%)	3 (3.2%) (95% CI 1.1% to 9.1%)	5 (4.0%) (95% CI 1.7% to 9.1%)	8 (9.0%) (95% CI 4.6% to 16.8%)	3 (3.3%) (95% CI 1.1% to 9.3%)	6 (7.5%) (95% CI 3.5% to 15.4%)	3 (3.4%) (95% CI 1.2% to 9.6%)	**49 (4.5% (95% CI 3.4% to 5.9%)**
Explosive	0	0	0	0	1 (1.1%) (95% CI 0.2% to 6.2%)	0	1 (0.8%) (95% CI 0.1% to 4.4%)	3 (3.4%) (95% CI 1.2% to 9.5%)	1 (1.1%) (95% CI 0.2% to 6.0%)	3 (3.8%) (95% CI 1.3% to 10.5%)	7 (8.0%) (95% CI 3.9% to 15.5%)	**16 (1.5%) (95% CI 0.9% to 2.4%)**
Total by Age	**131**	**113**	**91**	**98**	**87**	**93**	**124**	**89**	**90**	**80**	**88**	**1084**

Appendix 21 – Burn injury agent by year of age in the Children's Burns Research Network Database

Agent	Age (years)											Total Agent
	5	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
Hot Drink	22 (16.8% (95% CI 11.4% to 24.1%)	15 (13.3% (95% CI 8.2% to 20.8%)	21 (23.1% (95% CI 15.6% to 32.7%)	22 (22.4% (95% CI 15.3% to 31.7%)	13 (14.9% (95% CI 8.9% to 23.9%)	17 (18.3% (95% CI 11.7% to 27.3%)	19 (15.3% (95% CI 10.0% to 22.7%)	14 (15.7% (95% CI 9.6% to 24.7%)	15 (16.7% (95% CI 10.4% to 25.7%)	4 (5.0% (95% CI 2.0% to 12.2%)	11 (12.5% (95% CI 7.1% to 21.0%)	**173 (16.0% (95% CI 13.9% to 18.4%)**
Hot Food	10 (7.6% (95% CI 4.2% to 13.5%)	12 (10.6% (95% CI 6.2% to 17.7%)	8 (8.8% (95%CI 4.5% to 16.4%)	13 (13.3% (95% CI 7.9% to 21.4%)	15 (17.2% (95% CI 10.7% to 26.5%)	13 (14.0% (95% CI 8.4% to 22.5%)	12 (9.7% (95% CI 5.6% to 16.2%)	13 (14.6% (95% CI 8.7% to 23.4%)	13 (14.4% (95% CI 8.6% to 23.2%)	8 (10.0% (95% CI 5.2% to 18.5%)	9 (10.2% (95% CI 5.5% to 18.3%)	**126 (11.6% (95% CI 9.9% to 13.7%)**
Hot Water	22 (16.8% (95% CI 11.4% to 24.1%)	24 (21.2% (95% CI 14.7% to 29.7%)	19 (20.9% (95% CI 13.8% to 30.3%)	24 (24.5% (95% CI 17.1% to 33.9%)	26 (29.9% (95% CI 21.3% to 40.2%)	27 (29.0% (95% CI 20.8% to 38.9%)	37 (29.8% (95% CI 22.5% to 38.4%)	18 (20.2% (95% CI 13.2% to 29.7%)	23 (25.6% (95% CI 17.7% to 35.4%)	13 (16.3% (95% CI 9.8% to 25.8%)	19 (21.6% (95% CI 14.3% to 31.3%)	**252 (23.2% (95% CI 20.8% to 25.9%)**
Cooking Appliances/Oven	27 (20.6% (95% CI 14.6% to 28.3%)	18 (16.0% (95% CI 10.3% to 23.8%)	10 (11.0% (95% CI 6.1% to 19.1%)	9 (9.2% (95% CI 4.9% to 16.5%)	8 (9.2% (95% CI 4.7% to 17.1%)	9 (9.7% (95% CI 5.2% to 17.4%)	5 (4.0% (95% CI 1.7% to 9.1%)	5 (5.6% (95% CI 2.4% to 12.5%)	3 (3.3% (95% CI 1.1% to 9.3%)	2 (2.6% (95% CI 0.7% to 8.7%)	11 (12.5% (95% CI 7.1% to 21.0%)	**107 (9.9% (95% CI 8.2% to 11.8%)**
Hair Styling Devices	7	9	4	1	1	3	9	3	7	10	6	**60**

	(5.3%) (95% CI 2.6% to 10.6%)	(8.0%) (95% CI 4.2% to 14.4%)	(4.4%) (95% CI 1.7% to 10.8%)	(1.0%) (95% CI 0.2% to 5.6%)	(1.1%) (95% CI 0.2% to 6.2%)	(3.2%) (95% CI 1.1% to 9.1%)	(7.3%) (95% CI 3.9% to 13.2%)	(3.4%) (95% CI 1.2% to 9.5%)	(7.8%) (95% CI 3.8% to 15.2%)	(12.6%) (95% CI 6.9% to 21.5%)	(6.8%) (95% CI 3.2% to 14.1%)	**(5.5%) (95% CI 4.3% to 7.1%)**
Iron	4 (3.1%) (95% CI 1.2% to 7.6%)	7 (6.2%) (95% CI 3.0% to 12.2%)	1 (1.1%) (95% CI 0.2% to 6.0%)	6 (6.1%) (95% CI 2.8% to 12.7%)	4 (4.6%) (95% CI 1.8% to 11.2%)	1 (1.1%) (95% CI 0.2% to 5.9%)	1 (0.8%) (95% CI 0.1% to 4.4%)	0	3 (3.3%) (95% CI 1.1% to 9.3%)	1 (1.3%) (95% CI 0.2% to 6.8%)	1 (1.1%) (95% CI 0.2% to 6.2%)	**29 (2.7%) (95% CI 1.9% to 3.8%)**
Radiator	6 (4.6%) (95% CI 2.1% to 9.6%)	1 (0.9%) (95% CI 0.2% to 4.8%)	4 (4.4%) (95% CI 1.7% to 10.8%)	1 (1.0%) (95% CI 0.2% to 5.6%)	1 (1.1%) (95% CI 0.2% to 6.2%)	1 (1.1%) (95% CI 0.2% to 5.9%)	0	0	1 (1.1%) (95% CI 0.2% to 6.0%)	0	1 (1.1%) (95% CI 0.2% to 6.2%)	**16 (1.5%) (95% CI 0.9% to 2.4%)**
Aerosol	0	0	0	1 (1.0%) (95% CI 0.2% to 5.6%)	0	2 (2.2%) (95% CI 0.6% to 7.5%)	4 (3.2%) (95% CI 1.3% to 8.0%)	8 (9.0%) (95% CI 4.6% to 16.8%)	6 (6.7%) (95% CI 3.1% to 13.8%)	10 (12.6%) (95% CI 6.9% to 21.5%)	6 (6.8%) (95% CI 3.2% to 14.1%)	**37 (3.4%) (95% CI 2.5% to 4.7%)**
Sun	4 (3.1%) (95% CI 1.2% to 7.6%)	4 (3.5%) (95% CI 1.4% to 8.8%)	3 (3.3%) (95% CI 1.1% to 9.3%)	6 (6.1%) (95% CI 2.8% to 12.7%)	4 (4.6%) (95% CI 1.8% to 11.2%)	3 (3.2%) (95% CI 1.1% to 9.1%)	5 (4.0%) (95% CI 1.7% to 9.1%)	8 (9.0%) (95% CI 4.6% to 16.8%)	3 (3.3%) (95% CI 1.1% to 9.3%)	6 (7.6%) (95% CI 3.5% to 15.4%)	3 (3.4%) (95% CI 1.2% to 9.6%)	**49 (4.5%) (95% CI 3.4% to 5.9%)**
Fireworks	0	4 (3.5%) (95% CI 1.4% to 8.8%)	2 (2.2%) (95% CI 0.6% to 7.7%)	2 (2.0%) (95% CI 0.6% to 7.1%)	2 (2.3%) (95% CI 0.6% to 8.0%)	1 (1.1%) (95% CI 0.2% to 5.9%)	4 (3.2%) (95% CI 1.3% to 8.0%)	1 (1.1%) (95% CI 0.2% to 6.1%)	2 (2.2%) (95% CI 0.6% to 7.7%)	4 (5.0%) (95% CI 2.0% to 12.2%)	6 (6.8%) (95% CI 3.2% to 14.1%)	**28 (2.6%) (95% CI 1.8% to 3.7%)**

Vehicle Exhausts	5 (3.8%) (95% CI 1.6% to 8.6%)	2 (1.8%) (95% CI 0.5% to 6.2%)	3 (3.3%) (95% CI 1.1% to 9.3%)	3 (3.1%) (95% CI 1.1% to 8.6%)	0	5 (5.4%) (95% CI 2.3% to 12.0%)	3 (2.4%) (95% CI 0.8% to 6.9%)	3 (3.4%) (95% CI 1.2% to 9.5%)	2 (2.2%) (95% CI 0.6% to 7.7%)	2 (2.6%) (95% CI 0.7% to 8.7%)	1 (1.1%) (95% CI 0.2% to 6.2%)	**29 (2.7%) (95% CI 1.9% to 3.8%)**
Petrol	0	0	1 (1.1%) (95% CI 0.2% to 6.0%)	0	0	0	1 (0.8%) (95% CI 0.1% to 4.4%)	1 (1.1%) (95% CI 0.2% to 6.1%)	1 (1.1%) (95% CI 0.2% to 6.0%)	2 (2.6%) (95% CI 0.7% to 8.7%)	3 (3.4%) (95% CI 1.2% to 9.6%)	**9 (0.8%) (95% CI 0.4% to 1.6%)**
Outdoor Heat/Fire Source	8 (6.1%) (95% CI 3.1% to 11.6%)	5 (4.4%) (95% CI 1.9% to 9.9%)	7 (7.7%) (95% CI 3.8% to 15.0%)	1 (1.0%) (95% CI 0.2% to 5.6%)	1 (1.1%) (95% CI 0.2% to 6.2%)	4 (4.3%) (95% CI 1.9% to 10.5%)	5 (4.0%) (95% CI 1.7% to 9.1%)	3 (3.4%) (95% CI 1.2% to 9.5%)	2 (2.2%) (95% CI 0.6% to 7.7%)	2 (2.6%) (95% CI 0.7% to 8.7%)	1 (1.1%) (95% CI 0.2% to 6.2%)	**39 (3.6%) 995% CI 2.6% to 4.9%)**
Other	14 (10.7%) (95% CI 6.5% to 17.1%)	11 (9.7%) (95% CI 5.5% to 16.6%)	8 (8.8%) (95% CI 4.5% to 16.4%)	8 (8.2%) (95% CI 4.2% to 15.3%)	12 (13.8%) (95% CI 8.1% to 22.6%)	7 (7.5%) (95% CI 3.7% to 14.7%)	19 (15.3%) (95% CI 10.0% to 22.7%)	12 (13.5%) (95% CI 7.9% to 22.1%)	9 (10.0%) (95% CI 5.4% to 17.9%)	15 (18.8%) (95% CI 11.7% to 28.7%)	10 (11.4%) (95% CI 6.3% to 19.7%)	**125 (11.5%) (95% CI 9.8% to 13.6%)**
Missing	2 (1.5%) (95% CI 0.4% to 5.4%)	1 (0.9%) (95% CI 0.2% to 4.8%)	0	1 (1.0%) (95% CI 0.2% to 5.6%)	0	0	0	0	0	1 (1.3%) (95% CI 0.2% to 6.8%)	0	**5 (0.5%) (95% CI 0.2% to 1.1%)**
Total by Age	**131**	**113**	**91**	**98**	**87**	**93**	**124**	**89**	**90**	**80**	**88**	**1084**

Appendix 22 - Burn injury mechanism by year of age in the Children's Burns Research Network Database

Mechanism	Age (years)											Total Mechanism
	5	6	7	8	9	10	11	12	13	14	15	
Immersion	0	3 (2.7%) (95% CI 0.9% to 7.5%)	0	2 (2.0%) (95% CI 0.6% to 7.1%)	0	0	0	0	0	0	1 (1.1%) (95% CI 0.2% to 6.2%)	**6 (0.6%)**
Touch	58 (45.0%) (95% CI 36.1% to 52.8%)	43 (38.1%) (95% CI 29.6% to 47.3%)	26 (28.6%) (95% CI 20.3% to 38.6%)	26 (26.5%) (95% CI 18.8% to 36.0%)	28 (32.2%) (95% CI 23.3% to 42.6%)	21 (22.6%) (95% CI 15.3% to 32.1%)	33 (26.6%) (95% CI 19.6% to 35.0%)	16 (18.0%) (95% CI 11.4% to 27.2%)	23 (25.6%) (95% CI 17.7% to 35.4%)	22 (27.5%) (95% CI 18.9% to 38.1%)	26 (29.5%) (95% CI 21.0% to 39.8%)	**322 (29.7%)**
Spill	27 (20.6%) (95% CI 14.6% to 28.3%)	24 (21.2%) (95% CI 14.7% to 29.7%)	32 (35.2%) (95% CI 26.1% to 45.4%)	35 (35.7%) (95% CI 26.9% to 45.6%)	35 (40.2%) (95% CI 30.6% to 50.7%)	40 (43.0%) (95% CI 33.4% to 53.2%)	34 (27.4%) (95% CI 20.3% to 35.9%)	25 (28.1%) (95% CI 19.8% to 38.2%)	33 (36.7%) (95% CI 27.5% to 47.0%)	18 (22.5%) (95% CI 14.7% to 32.8%)	28 (31.8%) (95% CI 23.0% to 42.1%)	**331 (30.5%)**
Fell/Ran Into	12 (9.2%) (95% CI 5.3% to 15.3%)	6 (5.3%) (95% CI 2.5% to 11.1%)	12 (13.2%) (95% CI 7.7% to 21.7%)	4 (4.1%) (95% CI 1.6% to 10.0%)	5 (5.7%) (95% CI 24.8% to 12.8%)	6 (6.5%) (95% CI 3.0% to 13.4%)	8 (6.5%) (95% CI 3.3% to 12.2%)	3 (3.4%) (95% CI 1.2% to 9.5%)	1 (1.1%) (95% CI 0.2% to 6.0%)	1 (1.3%) (95% CI 0.2% to 6.8%)	0	**58 (5.4%)**
Pull Down	7 (5.3%) (95% CI 2.6% to 10.6%)	8 (7.1%) (95% CI 3.6% to 13.4%)	5 (5.5%) (95% CI 2.4% to 12.2%)	6 (6.1%) (95% CI 2.8% to 12.7%)	1 (1.1%) (95% CI 0.2% to 6.2%)	5 (5.4%) (95% CI 2.3% to 12.0%)	4 (3.2%) (95% CI 1.3% to 8.0%)	2 (2.2%) (95% CI 0.6% to 7.8%)	1 (1.1%) (95% CI 0.2% to 6.0%)	1 (1.3%) (95% CI 0.2% to 6.8%)	2 (2.3%) (95% CI 0.6% to 7.9%)	**42 (3.9%)**

Splash	9 (6.9% (95% CI 3.7% to 12.5%)	5 (4.4% (95% CI 1.9% to 9.9%)	6 (6.6% (95% CI 3.1% to 13.6%)	7 (7.1% (95% CI 3.5% to 14.0%)	6 (6.9% (95% CI 3.2% to 14.2%)	10 (10.8% (95% CI 5.9% to 18.7%)	18 (14.5% (95% CI 9.4% to 21.8%)	11 (12.4% (95% CI 7.0% to 20.8%)	14 (15.6% (95% CI 9.5% to 24.4%)	5 (6.3% (95% CI 2.7% to 13.8%)	7 (8.0% (95% CI 3.9% to 15.5%)	**98 (9.0%)**
Exposure to Sun	4 (3.1% (95% CI 1.2% to 7.6%)	4 (3.5% (95% CI 1.4% to 8.8%)	3 (3.3% (95% CI 1.1% to 9.3%)	6 (6.1% (95% CI 2.8% to 12.7%)	4 (4.6% (95% CI 1.8% to 11.2%)	3 (3.2% (95% CI 1.1% to 9.1%)	5 (4.0% (95% CI 1.7% to 9.1%)	8 (9.0% 95% CI 4.6% to 16.8%)	3 (3.3% (95% CI 1.1% to 9.3%)	6 (7.5% (95% CI 3.5% to 15.4%)	3 (3.4% (95% CI 1.2% to 9.6%)	**49 (4.5%)**
Spray	0	0	0	0	0	1 (1.1% (95% CI 0.2% to 5.9%)	3 (2.4% (95% CI 0.8% to 6.9%)	4 (4.5% (95% CI 1.8% to 11.0%)	3 (3.3% (95% CI 1.1% to 9.3%)	6 (7.5% (95% CI 3.5% to 15.4%)	1 (1.1% (95% CI 0.2% to 6.2%)	**18 (1.7%)**
Explosion	0	4 (3.5% (95% CI 1.4% to 8.8%)	1 (1.1% (95% CI 0.2% to 6.0%)	2 (2.0% (95% CI 0.6% to 7.1%)	2 (2.3% (95% CI 0.6% to 8.0%)	1 (1.1% (95% CI 0.2% to 5.9%)	7 (5.7% (95% CI 2.8% to 11.2%)	7 (7.9% (95% CI 3.9% to 15.4%)	4 (4.4% (95% CI 1.7% to 10.9%)	10 (12.5% (95% CI 6.9% to 21.5%)	12 (13.6% (95% CI 8.0% to 22.3%)	**50 (4.6%)**
Other	12 (9.2%)	12 (10.6% (95% CI 6.2% to 17.7%)	4 (4.4% (95% CI 1.7% to 10.8%)	8 (8.2% (95% CI 4.2% to 15.3%)	4 (4.6% (95% CI 1.8% to 11.2%)	3 (3.2% (95% CI 1.1% to 9.1%)	10 (8.1% (95% CI 4.4% to 14.2%)	9 (10.1% (95% CI 5.4% to 18.1%)	7 (7.8% (95% CI 3.8% to 15.2%)	10 (12.5% (95% CI 6.9% to 21.5%)	6 (6.8% (95% CI 3.2% to 14.1%)	**85 (7.8%)**
Not Known	1 (0.8%)	2 (1.8%)	2 (2.2%)	2 (2.0%)	1 (1.1%)	3 (3.2%)	0	3 (3.4%)	1 (1.1%)	1 (1.3%)	2 (2.3%)	**18 (1.6%)**

	(95% CI 0.1% to 4.2%)	(95% CI 0.5% to 6.2%)	(95% CI 0.6% to 7.7%)	(95% CI 0.6% to 7.1%)	(95% CI 0.2% to 6.2%)	(95% CI 1.1% to 9.1%)		(95% CI 1.2% to 9.5%)	(95% CI 0.2% to 6.0%)	(95% CI 0.2% to 6.8%)	(95% CI 0.6% to 7.9%)	
Missing	1 (0.8%) (95% CI 0.1% to 4.2%)	2 (1.8%) (95% CI 0.5% to 6.2%)	0	0	1 (1.1%) (95% CI 0.2% to 6.2%)	0	2 (1.6%) (95% CI 0.4% to 5.7%)	1 (1.1%) (95% CI 0.2% to 6.1%)	0	0	0	**7 (0.6%)**
Total by Age	**131**	**113**	**91**	**98**	**87**	**93**	**124**	**89**	**90**	**80**	**88**	**1084**

Appendix 23 – Scald injuries by age group (years), agent and mechanism for Children's Burns Research Network Database

	Hot Water (248)	Hot Drinks (173)	Hot Food (103)	Other (8)
Mechanisms in those aged 5 – 7 years Total number of children (148)				
Spill	27 18.2% (95% CI 12.9% to 25.2%)	38 25.7% (95% CI 19.3% to 33.3%)	15 10.1% (95% CI 6.2% to 16.1%)	-
Splash	12 8.1% (95% CI 4.7% to 13.6%)	4 2.7% (95% CI 1.1% to 6.7%)	4 2.7% (95% CI 1.1% to 6.7%)	-
Pull down	9 6.1% (95% CI 3.2% to 11.2%)	7 4.7% (95% CI 2.3% to 9.4%)	4 2.7% (95% CI 1.1% to 6.7%)	-
Fell/Ran into	5 3.4% (95% CI 1.5% to 7.8%)	4 2.7% (95% CI 1.1% to 6.7%)	2 1.4% (95% CI 0.4% to 4.8%)	-
Touch	-	-	-	1 0.7% (95% CI 0.1% to 3.7%)
Immersion	3 2.0% (95% CI 0.7% to 5.8%)	-	-	-
Explosion	2 1.4% (95% CI 0.4% to 4.8%)	-	-	-
Other	6 4.1% (95% CI 1.9% to 8.6%)	2 1.4% (95% CI 0.4% to 4.8%)	-	-
Not known	-	1 0.7% (95% CI 0.1% to 3.7%)	-	-
Missing	-	2 1.4% (95% CI 0.4% to 4.8%)	-	-
Mechanisms in those aged 8 – 10 years Total number of children (166)				
Spill	46 27.7% (95% CI 21.5% to 35.0%)	40 24.1% (95% CI 18.2% to 31.3%)	19 11.4% (95% CI 7.5% to 17.2%)	1 0.6% (95% CI 0.1% to 3.3%)
Splash	14 8.4% (95% CI 5.1% to 13.7%)	2 1.2% (95% CI 0.3% to 4.3%)	6 3.6% (95% CI 1.7% to 7.7%)	1 0.6% (95% CI 0.1% to 3.3%)

Pull down	4 2.4% (95% CI 0.9% to 6.0%)	3 1.8% (95% CI 0.6% to 5.2%)	2 1.2% (95% CI 0.3% to 4.3%)	-
Fell/Ran into	4 2.4% (95% CI 0.9% to 6.0%)	3 1.8% (95% CI 0.6% to 5.2%)	2 1.2% (95% CI 0.3% to 4.3%)	-
Touch	4 2.4% (95% CI 0.9% to 6.0%)	1 0.6% (95% CI 0.1% to 3.3%)	1 0.6% (95% CI 0.1% to 3.3%)	1 0.6% (95% CI 0.1% to 3.3%)
Immersion	-	-	2 1.2% (95% CI 0.3% to 4.3%)	-
Other	4 2.4% (95% CI 0.9% to 6.0%)	1 0.6% (95% CI 0.1% to 3.3%)	2 1.2% (95% CI 0.3% to 4.3%)	-
Not known	-	2 1.2% (95% CI 0.3% to 4.3%)	-	1 0.6% (95% CI 0.1% to 3.3%)
Mechanisms in those aged 11 – 13 years Total number of children (157)				
Spill	40 25.5% (95% CI 19.3% to 32.8%)	31 19.7% (95% CI 14.3% to 26.7%)	17 10.8% (95% CI 6.9% to 16.7%)	-
Splash	21 13.4% (95% CI 8.9% to 19.6%)	10 6.4% (95% CI 3.5% to 11.3%)	10 6.4% (95% CI 3.5% to 11.3%)	-
Pull down	2 1.3% (95% CI 0.4% to 4.5%)	4 2.5% (95% CI 1.0% to 6.4%)	1 0.6% (95% CI 0.1% to 3.5%)	-
Fell/Ran into	2 1.3% (95% CI 0.4% to 4.5%)	1 0.6% (95% CI 0.1% to 3.5%)	-	-
Touch	2 1.3% (95% CI 0.4% to 4.5%)	1 0.6% (95% CI 0.1% to 3.5%)	1 0.6% (95% CI 0.1% to 3.5%)	1 0.6% (95% CI 0.1% to 3.5%)
Spray	1 0.6% (95% CI 0.1% to 3.5%)	-	-	-
Other	6 3.8% (95% CI 1.8% to 8.1%)	-	1 0.6%	-

			(95% CI 0.1% to 3.5%)	
Not known	1 0.6% (95% CI 0.1% to 3.5%)	1 0.6% (95% CI 0.1% to 3.5%)	-	-
Missing	2 1.3% (95% CI 0.4% to 4.5%)	-	1 0.6% (95% CI 0.1% to 3.5%)	-
Mechanisms in those aged 14 – 15 years Total number of children (61)				
Spill	19 31.2% (95% CI 20.9% to 43.6%)	11 18.0% (95% CI 10.4% to 29.5%)	10 16.4% (95% CI 9.2% to 27.6%)	-
Splash	5 8.2% (95% CI 3.6% to 17.8%)	2 3.3% (95% CI 0.9% to 11.2%)	3 4.9% (95% CI 1.7% to 13.5%)	1 1.6% (95% CI 0.3% to 8.7%)
Pull down	2 3.3% (95% CI 0.9% to 11.2%)	-	-	-
Touch	1 1.6% (95% CI 0.3% to 8.7%)	-	-	1
Immersion	1 1.6% (95% CI 0.3% to 8.7%)	-	-	-
Other	3 4.9% (95% CI 1.7% to 13.5%)	-	-	-
Not known		2 3.3% (95% CI 0.9% to 11.2%)	-	-

Appendix 24 – Contact injuries by age group (years), agent and mechanism for Children's Burns Research Network Database

	Cooking Appliances/Oven	Hair Styling Devices	Outdoor Heat/Fire Source	Iron	Radiator	Vehicle Exhausts	Other
Mechanisms in those aged 5 – 7 years Total number of children (153)							
Spill	-	-	-	-	-	-	2 1.3% (95% CI 0.4% to 4.6%)
Fell/Ran into	4 2.6% (95% CI 1.0% to 6.5%)	2 1.3% (95% CI 0.4% to 4.6%)	4 2.6% (95% CI 1.0% to 6.5%)	1 0.7% (95% CI 0.1% to 4.1%)	1 0.7% (95% CI 0.1% to 4.1%)	1 0.7% (95% CI 0.1% to 4.1%)	2 1.3% (95% CI 0.4% to 4.6%)
Touch	50 32.7% (95% CI 25.8% to 40.5%)	16 10.5% (95% CI 6.5% to 16.3%)	12 7.8% (95% CI 4.5% to 13.2%)	8 5.2% (95% CI 2.7% to 10.0%)	10 6.5% (95% CI 3.6% to 11.6%)	7 4.6% (95% CI 2.2% to 9.2%)	17 11.1% (95% CI 7.1% to 17.1%)
Explosion	-	-	1 0.7% (95% CI 0.1% to 4.1%)	-	-	-	2 1.3% (95% CI 0.4% to 4.6%)
Other	-	2 1.3% (95% CI 0.4% to 4.6%)	1 0.7% (95% CI 0.1% to 4.1%)	3 2.0% (95% CI 0.7% to 5.6%)	-	-	4 2.6% (95% CI 1.0% to 6.5%)
Not known	-	-	-	-	-	1 0.7% (95% CI 0.1% to 4.1%)	1 0.7% (95% CI 0.1% to 4.1%)

Missing	-	-	-	-	-	-	1 0.7% (95% CI 0.1% to 4.1%)
Mechanisms in those aged 8 – 10 years Total number of children (81)							
Spill	-	-	-	-	-	-	3 3.7% (95% CI 1.3% to 10.3%)
Pull down	-	-	-	2 2.3% (95% CI 0.7% to 8.6%)	-	-	-
Fell/Ran into	1 1.2% (95% CI 0.1% to 6.7%)	-	1 1.2% (95% CI 0.1% to 6.7%)	2 2.3% (95% CI 0.7% to 8.6%)	1 1.2% (95% CI 0.1% to 6.7%)	-	-
Touch	25 30.9% (95% CI 21.9% to 41.6%)	4 4.9% (95% CI 1.9% to 12.0%)	2 2.3% (95% CI 0.7% to 8.6%)	5 6.2% (95% CI 2.7% to 13.7%)	1 1.2% (95% CI 0.1% to 6.7%)	6 7.4% (95% CI 3.4% to 15.2%)	20 24.7% (95% CI 16.6% to 35.1%)
Explosion	-	-	-	-	-	-	3 3.7% (95% CI 1.3% to 10.3%)
Not known	-	-	-	1 1.2% (95% CI 0.1% to 6.7%)	-	2 2.3% (95% CI 0.7% to 8.6%)	-
Missing	-	-	-	1 1.2%	-	-	1 1.2%

				(95% CI 0.1% to 6.7%)			(95% CI 0.1% to 6.7%)
Mechanisms in those aged 11 – 13 years Total number of children (83)							
Spill	-	-	-	-	-	-	2 2.4% (95% CI 0.7% to 8.4%)
Splash	-	-	-	-	-	-	1 1.2% (95% CI 0.2% to 6.5%)
Fell/Ran into	-	1 1.2% (95% CI 0.2% to 6.5%)	1 1.2% (95% CI 0.2% to 6.5%)	1 1.2% (95% CI 0.2% to 6.5%)	-	1 1.2% (95% CI 0.2% to 6.5%)	1 1.2% (95% CI 0.2% to 6.5%)
Touch	12 14.5% (95% CI 8.5% to 23.6%)	15 18.1% (95% CI 11.3% to 27.7%)	3 3.6% (95% CI 1.2% to 10.1%)	3 3.6% (95% CI 1.2% to 10.1%)	1 1.2% (95% CI 0.2% to 6.5%)	7 8.4% (95% CI 4.1% to 16.4%)	19 22.9% (95% CI 15.2% to 33.0%)
Explosion	-	-	-	-	-	-	3 3.6% (95% CI 1.2% to 10.1%)
Spray	-	-	-	-	-	-	1 1.2% (95% CI 0.2% to 6.5%)
Other	1 1.2% (95% CI 0.2% to 6.5%)	3 3.6% (95% CI 1.2% to 10.1%)	-	-	-	-	7 8.4% (95% CI 4.1% to 16.4%)

Mechanisms in those aged 14 – 15 years Total number of children (55)							
Spill	-	-	-	-	-	-	3 5.5% (95% CI 1.95 to 14.9%)
Pull down	-	-	-	1 1.8% (95% CI 0.3% to 9.6%)	-	-	-
Fell/Ran into	-	1 1.8% (95% CI 0.3% to 9.6%)	-	-	-	-	-
Touch	12 21.8% (95% CI 13.0% to 34.4%)	13 23.6% (95% CI 14.4% to 36.4%)	2 3.6% (95% CI 1.0% to 12.3%)	1 1.8% (95% CI 0.3% to 9.6%)	1 1.8% (95% CI 0.3% to 9.6%)	2 3.6% (95% CI 1.0% to 12.3%)	10 18.2% (95% CI 10.2% to 30.3%)
Explosion	-	-	-	-	-	-	5 9.1% (95% CI 4.0% to 19.6%)
Other	-	2 3.6% (95% CI 1.0% to 12.3%)	-	-	-	1 1.8% (95% CI 0.3% to 9.6%)	1 1.8% (95% CI 0.3% to 9.6%)

Appendix 25 – Time of day injury occurred by age group (years) in the Children's Burns Research Network Database

Age (years)	Morning	Lunch	Afternoon	Evening	Night	Missing	Total
5 – 7	35 (10.4%)	38 (11.3%)	85 (25.4%)	89 (26.6%)	12 (3.6%)	76 (22.7%)	335
8 – 10	34 (12.2%)	29 (10.4%)	50 (18.0%)	76 (27.3%)	15 (5.4%)	74 (26.6%)	278
11 – 13	31 (10.2%)	44 (14.5%)	64 (21.2%)	80 (26.4%)	16 (5.3%)	68 (22.4%)	303
14 - 15	11 (6.5%)	17 (10.1%)	31 (18.5%)	48 (28.6%)	15 (8.9%)	46 (27.4%)	168
Total	111 (10.2%)	128 (11.8%)	230 (21.2%)	293 (27.0%)	58 (5.4%)	264 (24.4%)	1084

Appendix 26 – Month and season of burn injury by age group (years) in Children's Burns Research Network Database

Age (years)	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Missing	Total
5 – 7	25 (7.5%)	40 (11.9%)	24 (7.2%)	31 (9.3%)	17 (5.1%)	26 (7.8%)	33 (9.9%)	28 (8.4%)	28 (8.4%)	22 (6.6%)	28 (8.4%)	31 (9.3%)	2 (0.6%)	335
8 – 10	19 (6.8%)	22 (7.9%)	19 (6.8%)	25 (9.0%)	17 (6.1%)	10 (3.6%)	35 (12.6%)	32 (11.5%)	23 (8.3%)	32 (11.5%)	16 (5.8%)	21 (7.6%)	7 (2.5%)	278
11 – 13	19 (6.3%)	21 (6.9%)	19 (6.3%)	25 (8.3%)	23 (7.6%)	18 (5.9%)	27 (8.9%)	39 (12.9%)	32 (10.6%)	35 (11.6%)	24 (7.9%)	18 (5.9%)	3 (1.0%)	303
14 - 15	13 (7.7%)	10 (6.0%)	10 (6.0%)	13 (7.7%)	6 (3.6%)	6 (3.6%)	11 (6.5%)	22 (13.1%)	17 (10.1%)	22 (13.1%)	20 (11.9%)	16 (9.5%)	2 (1.2%)	168
Total	76 (7.0%)	93 (8.6%)	72 (6.6%)	94 (8.7%)	63 (5.8%)	60 (5.5%)	106 (9.8%)	121 (11.2%)	100 (9.2%)	111 (10.2%)	88 (8.1%)	86 (7.9%)	14 (1.3%)	1084
	Winter			**Spring**			**Summer**			**Autumn**				
5 – 7	89 (26.6%) (95% CI 22.1% to 31.6%)			74 (22.1%) (95% CI 18.0% to 26.8%)			89 (26.6%) (95% CI 22.1% to 31.6%)			81 (24.2%) (95% CI 19.9% to 29.0%)			2 (0.6%) (95% CI 0.2% to 2.2%)	335
8 – 10	60 (21.6%) (95% CI 17.2% to 26.8%)			52 (18.7%) (95% CI 14.6% to 23.7%)			90 (32.4%) (95% CI27.1% to 38.1%)			69 (24.8%) (95% CI 20.1% to 30.2%)			7 (2.5%) (95% CI 1.2% to 5.1%)	278
11 – 13	59 (19.5%) (95% CI 15.4% to 24.3%)			66 (21.8%) (95% CI 17.5% to 26.8%)			98 (32.3%) (95% CI 27.3% to 37.8%)			77 (25.4%) (95% CI 20.8% to 30.6%)			3 (1.0%)	303

					(95% CI 0.3% to 2.9%)	
14 - 15	33 (19.6%) (95% CI 14.3% to 26.3%)	25 (14.9%) (95% CI 10.3% to 21.0%)	50 (29.8%) (95% CI 23.4% to 37.1%)	58 (34.5%) (95% CI 27.8% to 42.0%)	2 (1.2%) (95% CI 0.3% to 4.2%)	168
Total	241 (22.2%) (95% CI 19.9% to 24.8%)	217 (20.0%) (95% CI 17.8% to 22.5%)	327 (30.2%) (95% CI 27.5% to 33.0%)	285 (26.3%) (95% CI 23.8% to 29.0%)	14 (1.3%) (95% CI 0.8% to 2.2%)	1084

Appendix 27 – First-aid by age group (years) in Children's Burns Research Network Database

	Age Group (years)				Total
	5 – 7 (n = 335)	8 – 10 (n = 278)	11 – 13 (n = 303)	14 – 15 (n = 168)	(n = 1084)
Was first aid given?					
Yes	268 (80.0%)	218 (78.4%)	245 (80.9%)	123 (73.2%)	854 (78.8%)
No	16 (4.8%)	24 (8.6%)	12 (4.0%)	11 (6.5%)	63 (5.8%)
Missing	51 (15.2%)	36 (12.9%)	46 (15.2%)	34 (20.2%)	167 (15.4%)
If yes, was it cold water or other?					
Cold Water	179 (53.4%)	137 (49.3%)	160 (52.8%)	79 (47.0%)	555 (51.2%)
Other	89 (26.6%)	81 (29.1%)	85 (28.1%)	44 (26.2%)	299 (27.6%)
N/A	67 (20.0%)	60 (21.6%)	58 (19.1%)	45 (26.8%)	230 (21.2%)
If cold water was used, how was it applied?					
Cold Running Water	93 (27.8%)	61 (21.9%)	81 (26.7%)	42 (25.0%)	277 (25.6%)
Immersion	61 (18.2%)	59 (21.2%)	61 (20.1%)	28 (16.7%)	209 (19.3%)
Missing	25 (7.5%)	17 (6.1%)	18 (5.9%)	9 (5.4%)	69 (6.4%)
N/A	156	141	143	89	529

	(46.6%)	(50.7%)	(47.2%)	(53.0%)	(48.8%)
How long was the cold running water applied? (minutes)					
≤ 5	27 (8.1%)	26 (9.4%)	33 (10.9%)	13 (7.7%)	99 (9.1%)
6 – 10	49 (14.6%)	29 (10.4%)	33 (10.9%)	17 (10.1%)	128 (11.8%)
11 – 15	13 (3.9%)	18 (6.5%)	15 (5.0%)	10 (6.0%)	56 (5.2%)
16 – 19	0	0	1 (0.3%)	0	1 (0.1%)
20 ≥	47 (14.0%)	36 (12.9%)	51 (16.8%)	26 (15.5%)	160 (14.8%)
Missing	18 (5.4%)	11 (4.0%)	9 (3.0%)	4 (2.4%)	42 (3.9%)
N/A	181 (54.0%)	158 (56.8%)	161 (53.1%)	98 (58.3%)	598 (55.2%)
Was the injury covered?					
Yes	157 (46.9%)	110 (39.6%)	116 (38.3%)	53 (31.5%)	436 (40.2%)
No	78 (23.3%)	78 (28.1%)	98 (32.3%)	47 (28.0%)	301 (27.8%)
Missing	33 (9.9%)	30 (10.8%)	31 (10.2%)	23 (13.7%)	117 (10.8%)
N/A	67 (20.0%)	60 (21.6%)	58 (19.1%)	45 (26.8%)	230 (21.2%)
What was the injury covered with?					
Clingfilm	56 (16.7%)	46 (16.5%)	48 (15.8%)	19 (11.3%)	169 (15.6%)
T-Towel/Flannel	29	20	15	12	76

	(8.7%)	(7.2%)	(5.0%)	(7.1%)	(7.0%)
Cold Compress	6 (1.8%)	5 (1.8%)	5 (1.7%)	4 (2.4%)	20 (1.8%)
Wet Compress	5 (1.5%)	9 (3.2%)	9 (3.0%)	3 (1.8%)	26 (2.4%)
Bandage	10 (3.0%)	6 (2.2%)	11 (3.6%)	6 (3.6%)	33 (3.0%)
Plaster	5 (1.5%)	1 (0.4%)	4 (1.3%)	0	10 (0.9%)
Jelonet/Burn Dressing	9 (2.7%)	2 (0.7%)	6 (2.0%)	2 (1.2%)	19 (1.8%)
Other	10 (3.0%)	11 (4.0%)	8 (2.6%)	1 (0.6%)	30 (2.8%)
Missing	27 (8.1%)	10 (3.6%)	10 (3.3%)	6 (3.6%)	53 (4.9%)
N/A	178 (53.1%)	168 (60.4%)	187 (61.7%)	115 (68.5%)	648 (59.8%)
If 'other' treatment was applied, what was it?					
Ice	11 (3.3%)	11 (4.0%)	12 (4.0%)	5 (3.0%)	39 (3.6%)
Other Cooling Agent	11 (3.3%)	6 (2.2%)	5 (1.7%)	7 (4.2%)	29 (2.7%)
Sudocream	10 (3.0%)	6 (2.2%)	10 (3.3%)	4 (2.4%)	30 (2.8%)
Toothpaste	7 (2.1%)	4 (1.4%)	8 (2.6%)	4 (2.4%)	23 (2.1%)
Other Cream/Gel/Ointment	21 (6.3%)	24 (8.6%)	34 (11.2%)	13 (7.7%)	92 (8.5%)
Butter	0	0	1	0	1

			(0.3%)		(0.1%)
Honey	1 (0.3%)	0	1 (0.3%)	0	2 (0.2%)
Turmeric	0	0	1 (0.3%)	0	1 (0.1%)
Egg	4 (1.2%)	1 (0.4%)	1 (0.3%)	0	6 (0.6%)
Missing	24 (7.2%)	29 (10.4%)	12 (4.0%)	11 (6.5%)	76 (7.0%)
N/A	246 (73.4%)	197 (70.9%)	218 (72.0%)	124 (73.8%)	785 (72.4%)

Appendix 28 – Table of ages of compulsory education in OECD countries as defined by their state governing body

Country	Ages of Compulsory Education (years)	Reference Governing Body
Australia	5/6 – 15/16/17 (dependent on the State or Territory of residence)	Department of Education and Training, Australia (2018) https://www.education.gov.au/
Austria	6 – 15	The Austrian Federal Ministry of Education, Science and Research (2018)
Belgium	6 – 18	Flemish Ministry for Education (2018)
Canada	5/6 – 16/17/18 (dependent on the Province or Territory)	Ministry of Education, Canada (2018)
Chile	6 – 17	Chile Ministry of Education (2018)
Czech Republic	6 – 15	Ministry of Education, Youth and Sports, Czech Republic (2018)
Denmark	6 – 16	Ministry of Education, Denmark (2018)
Estonia	7 – 17	Estonian Ministry of Education and Research (2018)
Finland	7 – 16	Ministry of Education and Culture, Finland (2018)
France	6 – 16	Ministry of National Education, France (2018)
Germany	6 – 15	Federal Ministry of Education and Research, Germany (2018)
Greece	6 – 15	Ministry of Education, Research and Religious Affairs, Greece (2018)
Hungary	3 – 16	Ministry of Human Resources, Hungary (2018)
Iceland	6 – 16	Institute of Education, Iceland (2018)
Ireland	6 – 16	Department of Education and Skills, Ireland (2018)
Israel	6 – 18	Ministry of Education, Israel (2018)
Italy	6 – 16	Ministry of Education, University and Research, Italy (2018)
Japan	6 – 15	Ministry of Education, Culture, Sports, Science and Technology, Japan (2018)
Korea	6 – 14	Ministry of Education of Korea (2018)
Latvia	5 – 15/16	Ministry of Education and Science , Latvia (2018)
Luxembourg	4 – 16	Ministry of National Education, Childhood and Youth, Luxembourg (2018)
Mexico	6 – 18	The Mexican Secretariat of Public Education (2018)
Netherlands	5 – 16	The Ministry of Education, Culture and Science, Netherlands (2018)
New Zealand	6 – 16	Ministry of Education, New Zealand (2018)
Norway	6 – 16	Ministry of Education and Research, Norway (2018)
Poland	7 – 18	Ministry of Science and Higher Education, Poland (2018)

Portugal	6 – 15	The Ministry of Education, Portugal (2018)
Slovak Republic	6 – 15	Ministry of Education, Science, Research and Sport of the Slovak Republic (2018)
Slovenia	6 – 15	The National Education Institute of the Republic of Slovenia (2018)
Spain	6 – 16	Ministry of Education, Culture and Sport, Spain (2018)
Sweden	7 – 16	Ministry of Education and Research, Sweden (2018)
Switzerland	5/6 – 15 (dependent on Canton of residence)	The State Secretariat for Education, Research and Innovation, Switzerland (2018)
Turkey	5 – 17	Ministry of National Education, Turkey (2018)
United Kingdom	5 – 16 (In Northern Ireland children start school at 4, and ends at 18 years in England)	Department for Education, United Kingdom (2018)
United States of America	5/6/7/8 – 16/17/18 (dependent on State of residency)	U.S. Department of Education (2018)

Appendix 29 – Search strategy for systematic review 'What intervention prevention unintentional burns and scalds for school-aged children? A systematic review.' Search strategy developed for Ovid Medline.

1. (Child or children or childhood or schoolchild* or pupil or pupils or kid* or primary school* or elementary school* or junior school* or middle school* or prep school* or secondary school* or high school* or junior high school* or senior high school*).ti,ab.
2. Child/
3. 1 or 2
4. burns/
5. (scald* or burn*2 or burning or fire prevention).ti,ab.
6. (exp Accidents/ or exp Accidents, Home/ or exp Accident prevention/ or exp "Wounds and Injuries"/ or exp Fires/) and (hair straighten* or fireworks* or caustic or fire setting or firesetting or cooking or sparkler or aerosol* or hairspray* or flame* or fire or fires or bonfire*).ti,ab.
7. ((safety or injury or injuries or accident* or burn* or scald*) and (hair straighten* or hair dry* or hairdry* or firework* or caustic or fire setting or firesetting or cooking or baking or cooker* or oven* or chip pan* or hob* or stove* or sparkler or aerosol* or hairspray* or flame* or fire or fires or bonfire*)).ti,ab.
8. 4 or 5 or 6 or 7
9. (prevent* or avoid* or reduc* or protect*).ti,ab.
10. Primary prevention/ or secondary prevention/
11. ((improv* or educat* or aware* or increas*) adj5 home safety).ti,ab.
12. ((improv* or chang* or increas* or reduc*) adj5 (behavio#r* or practice or knowledge or awareness or attitude* or risk*1)).ti,ab.
13. (intervention*1 or evaluation*1 or program* or strateg* or educat*).ti,ab.
14. exp Health Knowledge, Attitudes, Practice/
15. 9 or 10 or 11 or 12 or 13 or 14
16. 3 and 8 and 15
17. emergency treatment/ or first aid/
18. ("first aid" or first response or prehospital care or emergency response or emergency treatment or emergency care).ti,ab.
19. 17 or 18
20. 3 and 19
21. (education* setting or primary education* or elementary education* or middle school* or junior school* or School or schools or pupil or pupils or schoolchild* or teacher* or curriculum).ti,ab.
22. schools/
23. ((holiday* or summer* or kid*) adj3 (camp* or school* or club*)).mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, kf, px, rx, ui, tc, id, tm]
24. (non-formal education* or community-based*).mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, kf, px, rx, ui, tc, id, tm]
25. ((training* or coaching*) adj3 sport*).mp. [mp=ti, ab, sh, hw, tn, ot, dm, mf, dv, kw, nm, kf, px, rx, ui, tc, id, tm]
26. (playgroup* or playschool* or playscheme* or after-school club* or recreation* or swim* or life-saving* or lifeguard* or girl guide* or girl-guide* or boy scout* or boy-scout* or red cross* or St John's ambulance*).ti,ab.
27. 21 or 22 or 23 or 24 or 25 or 26
28. 16 or 20
29. 27 and 28
30. limit 29 to english

31. limit 30 to yr="1995 -Current"
32. limit 31 to humans

Appendix 30 – Critical Appraisal Skills Programme Randomised Control Trial Checklist (CASP, 2017)

CASP
Critical Appraisal Skills Programme

Section A: Are the results of the trial valid?

1. Did the trial address a clearly focused issue?

Yes	
Can't Tell	
No	

HINT: An issue can be 'focused' In terms of
- the population studied
- the intervention given
- the comparator given
- the outcomes considered

Comments:

2. Was the assignment of patients to treatments randomised?

Yes	
Can't Tell	
No	

HINT: Consider
- how this was carried out
- was the allocation sequence concealed from researchers and patients

Comments:

3. Were all of the patients who entered the trial properly accounted for at its conclusion?

Yes	
Can't Tell	
No	

HINT: Consider
- was the trial stopped early
- were patients analysed in the groups to which they were randomised

Comments:

Is it worth continuing?

CASP
Critical Appraisal Skills Programme

4. Were patients, health workers and study personnel 'blind' to treatment?

Yes	
Can't Tell	
No	

Comments:

5. Were the groups similar at the start of the trial

Yes	
Can't Tell	
No	

HINT: Consider
• other factors that might affect the outcome, such as; age, sex, social class

Comments:

6. Aside from the experimental intervention, were the groups treated equally?

Yes	
Can't Tell	
No	

Comments:

Section B: What are the results?

CASP
Critical Appraisal Skills Programme

7. How large was the treatment effect?

HINT: Consider
- what outcomes were measured
- Is the primary outcome clearly specified
- what results were found for each outcome

Comments:

8. How precise was the estimate of the treatment effect?

HINT: Consider
- what are the confidence limits

Comments:

Section C: Will the results help locally?

9. Can the results be applied to the local population, or in your context?

Yes	
Can't Tell	
No	

HINT: Consider whether
- the patients covered by the trial are similar enough to the patients to whom you will apply this
- how they differ

Comments:

10. Were all clinically important outcomes considered?

Yes	
Can't Tell	
No	

HINT: Consider whether
- there is other information you would like to have seen
- if not, does this affect the decision

Comments:

CASP
Critical Appraisal
Skills Programme

11. Are the benefits worth the harms and costs?	Yes	☐	HINT: Consider • even if this is not addressed by the trial, what do **you** think?
	Can't Tell	☐	
	No	☐	

Comments:

Appendix 31 – Critical Appraisal Skills Programme Cohort Study Checklist (CASP, 2017)

CASP
Critical Appraisal Skills Programme

Section A: Are the results of the study valid?			
1. Did the study address a clearly focused issue?	Yes Can't Tell No	☐ ☐ ☐	HINT: A question can be 'focused' in terms of • the population studied • the risk factors studied • is it clear whether the study tried to detect a beneficial or harmful effect • the outcomes considered
Comments:			
2. Was the cohort recruited in an acceptable way?	Yes Can't Tell No	☐ ☐ ☐	HINT: Look for selection bias which might compromise the generalisability of the findings: • was the cohort representative of a defined population • was there something special about the cohort • was everybody included who should have been
Comments:			
Is it worth continuing?			

CASP
Critical Appraisal
Skills Programme

3. Was the exposure accurately measured to minimise bias?

Yes	
Can't Tell	
No	

HINT: Look for measurement or classification bias:

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
- were all the subjects classified into exposure groups using the same procedure

Comments:

4. Was the outcome accurately measured to minimise bias?

Yes	
Can't Tell	
No	

HINT: Look for measurement or classification bias:

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
- has a reliable system been established for detecting all the cases (for measuring disease occurrence)
- were the measurement methods similar in the different groups
- were the subjects and/or the outcome assessor blinded to exposure (does this matter)

Comments:

CASP
Critical Appraisal Skills Programme

5. (a) Have the authors identified all important confounding factors?

Yes	☐
Can't Tell	☐
No	☐

HINT:
- list the ones you think might be important, and ones the author missed

Comments:

5. (b) Have they taken account of the confounding factors in the design and/or analysis?

Yes	☐
Can't Tell	☐
No	☐

HINT:
- look for restriction in design, and techniques e.g. modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors

Comments:

6. (a) Was the follow up of subjects complete enough?

Yes	☐
Can't Tell	☐
No	☐

HINT: Consider
- the good or bad effects should have had long enough to reveal themselves
- the persons that are lost to follow-up may have different outcomes than those available for assessment
- in an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort

6. (b) Was the follow up of subjects long enough?

Yes	☐
Can't Tell	☐
No	☐

CASP
Critical Appraisal
Skills Programme

Comments:

Section B: What are the results?

7. What are the results of this study?

HINT: Consider
- what are the bottom line results
- have they reported the rate or the proportion between the exposed/unexposed, the ratio/rate difference
- how strong is the association between exposure and outcome (RR)
- what is the absolute risk reduction (ARR)

Comments:

8. How precise are the results?

HINT:
- look for the range of the confidence intervals, if given

Comments:

CASP
Critical Appraisal Skills Programme

9. Do you believe the results?

Yes	☐
Can't Tell	☐
No	☐

HINT: Consider
- big effect is hard to ignore
- can it be due to bias, chance or confounding
- are the design and methods of this study sufficiently flawed to make the results unreliable
- Bradford Hills criteria (e.g. time sequence, dose-response gradient, biological plausibility, consistency)

Comments:

Section C: Will the results help locally?

10. Can the results be applied to the local population?

Yes	☐
Can't Tell	☐
No	☐

HINT: Consider whether
- a cohort study was the appropriate method to answer this question
- the subjects covered in this study could be sufficiently different from your population to cause concern
- your local setting is likely to differ much from that of the study
- you can quantify the local benefits and harms

Comments:

11. Do the results of this study fit with other available evidence?

Yes	☐
Can't Tell	☐
No	☐

Comments:

CASP
Critical Appraisal
Skills Programme

12. What are the implications of this study for practice?	Yes ☐ Can't Tell ☐ No ☐	HINT: Consider • one observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making • for certain questions, observational studies provide the only evidence • recommendations from observational studies are always stronger when supported by other evidence

Comments:

Appendix 32 – Definitions of intervention types used in systematic review 'What intervention prevention unintentional burns and scalds for school-aged children? A systematic review.'

Intervention Type	Definition
Curriculum or Educational Scheme of Work	Intervention consists of more than one visit to deliver intervention content to participants in a school or community setting
Play or Game Based	Intervention consists of a play or game based activity
Safety Village	Intervention consists of one (or more) visits to a specifically built safety village.
Individual Education Session	Intervention consists of one visit to deliver intervention content to participants in a school or community setting

Appendix 33 – Characteristics of included studies (study characteristics, intervention characteristics, population characteristics and assigned global rating for risk of bias) in 'What intervention prevention unintentional burns and scalds for school-aged children? A systematic review.'

Study Details (First author, year, country, study design, intervention delivery site, intervention type, burn type)	**The Intervention** **(*name*, description of intervention and theoretical/epidemiological basis, training and fidelity)**	**Study population & Intervention/Comparison Groups**
Azeredo 2003 USA CBAS School Curriculum/Educational scheme of work Fire-related burn & home safety	Intervention includes: 18 or 27 week curricula and lesson plans for kindergarten – grade 1, 2 – 3, 4 – 5; smoke alarm give away; school bicycle fairs with helmet give away; safety penpal letters for third grade students; letters to parents and injury prevention talks at parent-teacher meetings. Lessons are 30 – 45 minutes for the main subjects included safety messages imbedded in the exercises and activities. Teaching materials were provided for teachers and safety folders for students. Curriculum was derived from epidemiologic evidence and injury prevention methods. Curriculum based on applied learning, behavioural and socialisation theories. Curriculum includes creative activities. Prevention messages are overt and subtle. No training was provided. No information on fidelity is reported.	5 - 11 year olds n = 6300 (12 schools, grades kindergarten to 5) One private and five public schools in intervention and control groups
Chavez et al. 2014 USA CBAS Community	*Danger Rangers Fire Safety Curriculum* Curriculum and intervention divided into pre-kindergarten – kindergarten, 1st to 2nd grade and 3rd grade to increase age appropriateness. Components include Danger Rangers' cartoon DVDs, storybooks, activity books and the opportunity to interact with a fire fighter. Kindergarten age group activities included matching	3/4 - 7/8 years old (Pre-kindergarten - Third grade) n = 166 Mean age = 6.9 years

Curriculum/Educational scheme of work Fire-related burn	pictures on fire safety and practicing responding to a fire. 1st – 2nd grade activities included a pledge to follow safety rules, writing and illustrating a book featuring fire safety rules, learning about the emergency telephone number (911) and how to make a call, kitchen safety rules, and creating and explaining their family fire escape plan. 3rd grade activities included discussing fire safety for different times of the year and learning fire safety tips through song. The intervention was delivered for four hours a day at a summer day camp for one week (five days). The curriculum is readily available nationally and internationally. Curriculum developed by Educational Adventures in collaboration with the American Association of Health Educators, Topics Education and classroom teachers. No further information on theoretical/epidemiological basis provided. Community leaders representative of the participants' cultural backgrounds taught the program. Leaders received four hours of training on program delivery. No information on intervention fidelity provided.	Gender = male 50% Race (n = 131) Hispanic = 27.5% Black = 68.7% Bi-racial = 3.8% Past history of burn injury (n = 141) = 6.4%
Frederick et al. 2000 UK NRCS School & Community Curriculum/Educational scheme of work Fire-related burn	*The Injury Minimization Programme for Schools (IMPS)* The intervention programme is delivered to 10 – 11 year olds (year 6) within the school curriculum and a hospital visit. The programme teaches children about risks, possible outcomes of risks, skills and knowledge to minimise impact of injury in the following relevant areas: accidents in the home, fire and electricity. Teachers are provided with an IMPS education resource pack for five months. Teachers are asked to have completed the basic core elements, before the second stage (hospital visit). During the hospital visit children were taught by IMPS trainers learning basic life support and CPR, an interactive video about common accidents and a tour of an accident and emergency department. Developed by a team of healthcare professionals in response to the Health of the Nation (1992) recommendations. IMPS hospital training staff received special instruction.	10 – 11 year olds n = 1292 (657 intervention group (12 schools), 635 control (15 schools)) Schools were matched on location, size and national curriculum test results
Harre 2000	The intervention was a kit of materials provided for schools. The intervention included two lessons (approximately 45 minutes in length) and five homework exercises. The format of the class began with a	5 – 11 years

NZ CBAS School Curriculum/Educational scheme of work Scalds	discussion followed with use of a flipchart to present key ideas including how and why children are being burnt in the home, risk awareness and prevention ideas using safe and unsafe pictures of appliances or objects e.g. pots, bath, microwave. Five homework exercises were distributed involving the child and parent identifying the whether items and their household practices were safe concerning them using a tickbox exercise sheet (6 pages). If their actions were unsafe they were asked to alter them – if not, they were ask to provide their reasons for not doing so. The intervention was delivered by public health nurses affiliated with each school. Prior to development of the intervention a survey was conducted to assess what activities school-aged (7 – 13 years) children were conducting that carry a burn risk. Survey results influenced intervention development. The intervention was also based on a previously used prevention program kit used by co-producers for parents of young children within the same community.	n = 135 (64 intervention (3 classes), 71 control (3 classes)) Intervention = Year 2 class n = 21, Year 4 class = 22, Year 6 class = 27 Control = Year 2 class n = 22, Year 4 class = 22, Year 6 class = n = 27 Gender = male n = 32 intervention, n = 38 control European decent = 40% Indigenous Maori = 26% Pacific Island descent = 22% Asian = 8% Other ethnic origins = 8% Socio-economic indicator = both schools decile 3 (Ministry of Education, NZ)
Moore et al. 2004 NZ *Retention follow-up from previous study* School Curriculum/Educational scheme of work	Following the evaluation of the intervention above the program was rolled-out to 28 classes across 14 primary schools in Waitakere to 8 - 9 year olds in the same manner as above with the additional use of a stove sticker, a bath hook and a drink coaster. Three schools from those who participated were recruited for the follow-up, now in Year 6. Safety knowledge of the current study (one-year after receiving the intervention) was compared to those from the original intervention and control schools.	10 - 11 years n = 116 (3 schools, n = 40, 41 and 35) Gender = male n = 73 66 (57%) indicated that they had one or more younger siblings

Scalds		Report a range of ethnicities to be represented but no figures provided: European, Pacific, Maori and Asian decent Socio-economic indicator = two schools decile 3, and one school decile 6 (Ministry of Education, NZ)
Kendrick et al. 2007 UK cRCT School Curriculum/Educational scheme of work Fire-related burn & cooking safety	*Risk Watch* Risk Watch is an injury prevention program developed in the USA, and adapted for the UK by Nottinghamshire Fire and Rescue Service. Educational approaches include making safer choices, resisting peer pressure to take risks and influencing family members and others to take action to reduce risks. Risk Watch folders and Risky Boxes are supplied to schools containing teaching resources, materials, teacher and student information. Included folders are targeted to years 3 and 4, with one to year 5. Folders cover eight topic areas - one of which is fire and burns. Participating schools taught at least one Risk Watch topic of their choice from the four chosen for evaluation. Teachers received training by Fire Service personnel.	7 – 10 year olds n = 459 (20 schools) (240 intervention, 219 control) Mean age = 8.35 years intervention, 8.74 control Gender = male 51.3% intervention, 52.3% control Family does not have a car = 26.6% intervention, 14.2% control
***Lamb et al. (S1)** 2006 UK NRCS Community Safety Village Fire-related burn & home safety	*Lifeskills* *Study 1 = Knowledge and performance of safety skills* Lifeskills is a safety education village designed for children aged 10 - 11 years. Children visit for 2 hours, rotating around 10 safety sets containing hazards in groups of three or four children with one adult. Children are encouraged to spot hazards and discuss ways of eliminating or avoiding them. Safety sets examples include a kitchen, a bathroom and a street.	10 - 11 years n = 145 (7 schools) (Intervention n = 109, control n = 36) Gender = male n = 67

	Lifeskills is underpinned by the ethos of learning by doing.	Schools selected to represent a range of achievement on the National Key Stage 2 SATs. Schools were placed into two group 'higher achieving' and 'lower achieving'. Control and intervention groups matched on gender and in terms of proportion of children from higher and lower achieving schools.
***Lamb et al. (S2)** 2006 UK CBAS (with additional retention testing) Community Safety village Fire-related burn & home safety	[As above] *Study 2 = Knowledge Acquisition and Retention*	10 - 11 years n = 671 (20 schools) (Intervention n = 511, control n = 160) Gender = male n = 345 School stratification as above.
Lehna et al. 2013 USA BAS School Individual Education Session Fire-related burn & general burn safety	*Hazard House* Intervention uses a model house (a 3D portable unit with lights that simulate fire and smoke) and presentation from local firefighters. Using a remote to light-up each room fire hazards were identified, discussed and corrections suggested with students. Intervention took approximately 30 minutes. Key points included: never playing with matches, never overloading power switches, never using electrical items near water, and ensuring that smoke alarms on each floor are working. Local firefighters presented on fire safety and the importance of working fire alarms. Intervention delivered to 25 – 50 students in an all-purpose room in their school. Following the intervention students were provided with a fire safety checklist to take and use at home.	5 - 13 years n = 500 (kindergarten to grade 4 students). Age range so large due to one student re-taking 1st and 2nd grade several times. Normal age range for grades = 5 – 9 years. Kindergarten, n = 128 (mean age = 5.48 years)

	Nursing students delivered the intervention. Nursing worked in teams and were assigned project roles. Those that delivered the intervention were trained (n = 3) via studying a script, watching a training DVD, and practicing delivery to classmates.	1st/2nd grade, n = 311 (mean age = 6.94 years) 3rd/4th grade, n = 61 (mean age = 7.98 years)
Mondozzi 2001 USA BAS School Play or game based Fire-related burn	*The Firefighter's Game and Smokey's House Game* The Firefighter's Game is a sheet game for classroom use. Smokey's House Game is a board game for two to six players. It was suggested that games were placed in the school library so as classes could check them out. The games were distributed with an information pack including a short overview of the pilot project and its goals, information forms and instructions for educators about the necessary feedback and data needed to test efficacy, suggestions about when and how to play the games, a summary of burn and fire prevention facts pre- and post-tests for students and evaluation forms. Games were also provided to fire service providers to use when attending schools. Both games were implemented by the teacher or the fire service personnel. No training in delivery were provided other than associated information pack.	7/8 & 9/10 years n = 338 (for analysis, 33% of all returned data could be used) n = 338 pre-test, n = 334 post-test (Though 164 elementary schools received intervention materials)
Morrongiello et al. 2012 USA RCT Community Play or game based Fire-related burn	*The Great Escape* An interactive cartoon computer game distributed to parents via CD-Rom for children to play on their home computer. Game used at home over a three-week period. Game designed to be played with minimal adult supervision. Children are given the task of helping a playful animal out of various fire-hazard situations. Game is narrated by Mrs. Aboutfire who teaches the children about fire safety and guiding on correct and incorrect choices in different scenarios. Game covers four scenarios: lighter and basic fire knowledge; home escape routes; what to do if your clothes catch fire and how to exit your bedroom safely if a fire is outside the room. Each time the game is played the scenarios are presented in different orders. Intervention pays attention to format, and with no on-screen reading for ease of use independently by younger children, game playing and education research. Game utilises repetition, interactivity, problem solving, positive feedback and self-evaluations. Computer game developed by firefighters as part of the Staying Alive program.	3.5 – 6 years n = 76 (36 randomly assigned to fire prevention game) Mean age = 4.77 intervention, 4.76 control Gender = male 53% intervention, 47% control Comparison group received a computer game on dog safety (The Blue Dog)

	Written instruction on the use and loading of the game were provided to parents.	Mothers highest level of education = 5.3% high school diploma/some dome high school courses, 64.9% university degree/some college or university courses, 29.8% some/all graduate school training. Annual gross household income = 4% <$20,000, 10% $20,000 - $39,999, 18% $40,000 - $59,999, 6% $60,000 - $79,999 and 61% >$80,000. 84% White, 8% African American and 8% other ethnicities.
Morrongiello et al. 2016 CAN cRCT School Curriculum/Educational scheme of work Fire-related burn, cooking safety & general burn safety	*The Safety Detective Program* Six lessons covering six topics approximately 40 mins each (fits to class period). Relevant topics include: general home safety, burns and general review of home safety. Each session had three activities: storybook, song and craft/game. Activities set-up in a circuit – children make their way around each in small groups, with a wrap-up at the end re-visiting main messages and safety slogan is rehearsed together. Children are provided a take-home activity. Parents provided with an information sheet. At the beginning of each session (where relevant) the take-home activity from the previous session is discussed. Trained undergraduate students delivered the program. Intervention based on findings from research in Educational Psychology, Child Development and The Health Belief Model. Use of an inductive reasoning approach (bottom-up inferences), emphasis placed on causal relations of how behaviours lead to negative consequences, situational examples, active encouragement to apply knowledge to new situations and creating new examples and a tutor-type cartoon dog character to increase attention, engagement and enhanced learning and memory.	4- 6 years n = 135 (n = 93 intervention (6 classes), n = 42 control (3 classes)) Mean age = 4.86 intervention, 4.95 control Gender = male 45% control, 53% intervention

	Training was provided for undergraduate students delivering the intervention. Program fidelity was assured through observations of all sessions conducted by a co-developer of the program via a standardised checklist for each session.	
Sinha et al. 2011 USA & IND (data extracted for USA only) BAS School Play or game based Fire-related burn, fireworks & burn safety in the home	*Tales of Burn Safety* Comic book read aloud in class – students read along with the teacher (approximately 35 min including pre- and post-test). Demographic and common causes of burn injury data reviewed for country of interest to identify key teaching points to tailor comic. No information provided on training for delivery or fidelity of intervention.	5 – 7 years n = 74 4 classes

*Lamb – two studies are reported within one paper. For the purpose of this review the study characteristics and results have been separated into 'S1' and 'S2'.

RCT = Randomised Control Trial, CBAS = Controlled Before and After Study, cRCT = Cluster Randomised Control Trial, NRCS = Non-randomised Control Study, BAS = Before and After Study

USA = United States of America, UK = United Kingdom, CAN = Canada, IND = India, NZ = New Zealand

Appendix 34 – Results of included studies (data collection and outcome measures, results by knowledge, attitude and practice, and other comments in 'What intervention prevention unintentional burns and scalds for school-aged children? A systematic review.'

Study Details (First author, year)	Data collection tool, Outcome Measures, Length of follow-up & Unit of measure	Results			Other Comments
		Knowledge	Attitude	Practice	
Azeredo* 2003	Written tests were conducted pre- and post-intervention to assess knowledge, attitude and behaviour (practice). Kindergarten – Grade 1 = 14 item activity and simple written questions Grades 2 – 5 = 20 item true/false and multiple choice questions.	Results show a statistically significant difference in students pre-test and post-test for knowledge questions relating to fire-safety rules for kindergarten – grade 1 in intervention school (p<.01) and for fire safety grades 2 – 5 (p<.01). No significant differences were shown between students post-test results between intervention and control schools in grades 2 -5 for home fire safety (p=.04).	N/A	N/A	-
Chavez et al. 2014	Teacher/researcher administered pre and post fire safety knowledge tests for participants. Post-test delivered following intervention completion (end of the week). Retention test delivered three weeks later. Questionnaires tailored to age groups relating to	Pre to post overall scores - 1st/2nd grade and 3rd grade scored significantly higher on the post-test compared to pre-test (p<.0001). Not significant for the kindergarten group (p = .14)	-	Significantly higher number of parents reported testing smoke detectors on a regular basis (80.2% to 93%, p = .0117) and having a fire escape plan for their family (45% to 73.9%,	-

	curriculum and fire safety rules taught. Self-administered questionnaires for parents of participants. Questionnaire containing demographic information, questions on previous injuries and current prevention practices for fire/burn related injuries delivered prior to intervention and three weeks following completion. Separate questionnaire delivered directly following intervention completion to assess children's engagement with the program by parental report.	Pre to retention overall scores – 1st/2nd grade and 3rd grade scored significantly higher on the retention compared to pre-test (p<.0001). Not significant for the kindergarten group (p = .89) Post to retention overall scores – 3rd grade scores significantly lower on the retention test compared to post (p<.001). No significant differences for kindergarten (p = 1.0) and 1st/2nd grade groups (p = .25)	p<.0001). No significant change in reports of the child never playing in the kitchen (p = 0.72), or in the home having a working smoke detector (p=1.00) (both commonly reported prior to intervention). 77.1% of parents returned surveys relating to child engagement. 97 parents (76.3%) reported that their child told them about 911, 64 (50.8%) that their child asked them to create a fire safety plan, 96 995%) that their child talked about safety in the kitchen, 94 (73.4%) that their child talked about fire safety rules, 82 (65.1%) their child mentioned Danger Rangers once or twice during intervention week and 29 (23%) that their child mentioned Danger Rangers every day.

Frederick et al.* 2000	Knowledge – specifically developed multiple choice quiz. Tested pre- and post-intervention and 5 months later for retention. Attitude – Draw and write exercise. A video was shown depicting an evolving story of a group of children engaging in dangerous activities. Children were asked to record their observations and further develop the story. Parental (n = 500) and teacher (n = 27) questionnaires were also administered to the intervention group to determine if IMPS programme influenced the children in their home and school environment. Unit of measure = child.	Accidents in the home (intervention = +0.5, control = +0.4), electrical safety (+0.4, +0.4), fire safety (+0.1, +0.2) and burns first aid (+0.2, +0.2) improved significantly from pre-test to post-test (p<.01). Intervention knowledge score for safety skills (+0.1) and Emergency 999 (+0.3) were significant (p<.01); but not for controls.	Draw and write results for identifying dangers for electrocution risk were statistically significant between intervention and control (intervention = 102, control = 40, p<.01). Results for stopping risky behaviour for not playing with a magnifying glass were statistically significant between intervention and control (intervention = 30, control = 13, p<.01).	N/A	36% of parents responded to questionnaires (n = 180). 74% (132) claimed that IMPS raised their child's awareness of safety issues and 26% (46) that their child had identified possible hazards around the home. 17.9% (32) of parents reported making changes in the home and 9% had helped others in danger. 97% of parents indicated that IMPS should be taught in all schools.
Harre 2000	Pre- and post-intervention quiz involving a picture task. Each child was shown a series of pictures individually and asked to comment what was unsafe about them. A correct mark was noted for each correct identification from a standardised list. 4 pictures were used, with 10 hazards. Children were also asked the safe	Mean score for correct identification of hazards was significantly improved for intervention, compared to control (p<.0005). Difference in means between pre and post for intervention school = Year 2 5.8, Year 4 6.7 and Year 6 8.1; control school = Year 2 0, Year 4 0.3 and Year 6 0.7.	-	61% of homework exercises were returned. Majority of families (67%) reported that they already had safe practices. Most (22%) families made the recommended changes. Most readily amenable change was keeping pot handles turned in on the stove.	Gender and ethnicity had no significant main effects or interaction effects so were not included in analysis. 46 parent questionnaires were completed. 73% of the homework

	temperature for household hot water. Homework exercise tickboxes were collected. Parent questionnaire were used to ascertain the how long the homework exercises had taken, whether they the intervention had improved their child's safety awareness and their opinions on the programme.	On average children at the intervention school could identify 6 more hazards post-intervention than the control school. Children in the higher levels at both intervention and control schools improved significantly more mover time than those in low year levels (p<.0005).			exercises were completed by the parent and child together. 96% indicated that the exercise had improved their child's awareness. 55% reported that the exercise was enjoyable for themselves and 80% that it was enjoyable for their child. Median time per exercise = 10 minutes.
Moore et al. 2004	Testing procedure same as above. Additional questions were asked as to whether children could remember the homework exercises. For each one they remembered they were asked if they still had it at home and its current and past use. Answers were coded as 'in current intended use', 'temporarily used as intended' and 'never used as intended'. If the item was not currently being used as intended students were asked follow-up questions to ascertain what had happened.	Results show that the follow-up group, and the previous intervention group do not differ significantly from each identifying more hazards than the control at post-intervention (p<.05, mean scores follow-up 7.60, intervention 7.62 and control 2.11). The mean test scores of School 2, in the current study, differed from School 3 (p<.05).	-	Parent interviews suggest that the homework exercise had more of an impact on electric jug use (n = 8), cooking pot safety (n = 11) and bath safety (n = 8) than on hot drink practices (n = 6) with regard to making a safety change following the exercises. Recall of items with the current group was high, 94% remembered the electric jug cord, 88% hot	No effect of gender on knowledge. Public Health Nurses suggested that the program may be better taught by classroom teachers.

	Parent telephone interviews were conducted to see if parents remembered the homework exercises and if the activities had any impact on practices. Public Health Nurses (who delivered the intervention) participated in telephone interviews were questioned about the feasibility of including the program as a regular part of their schedule, the effect of the level of teaching staff, effectiveness of homework exercises, the appropriateness of the age-group and how often the programme should be taught.	5.8% of children in the current study remembered the safe temperature of hot tap water, compared to 54% of the intervention, and 4.2% of the control.		drink coaster, 96% pot sticker and 91% label for the bath tap. 65% reported temporarily using the jug hook as intended, 70% the coaster, 71% the stove sticker and 79% the bath label. 29% still had the jug hook in intended use, 31% drinks coaster, 55% stove sticker and 48% bath label. 89% of children reported measuring their hot water temperature, of these 63% reported it to be within the safe range, 16% in the unsafe range and 22% could not remember.	
Kendrick et al. 2007	Knowledge and self-reported behaviour were measured using age-appropriate pencil and paper questionnaires pre- and post-intervention. Knowledge question were illustrated pictorially and required ticking boxes or circling hazards. Researchers read questions aloud. Prior to use questionnaire was piloted and amended twice.	Post-intervention those who were taught the burn specific module had a significantly higher percentage score than those in the control groups (difference between means = 7.0, p = .01) More effective in increasing fire and burn prevention knowledge amongst younger than older children (difference between means age 7 = 19.5%,	-	Post-intervention the percentage of fire and burn prevention skills correctly demonstrated by intervention compared to control was significantly higher (difference between means = 8.93, p = .01) 8.93 (1.67, 47.78), p = 0.01 Intervention children were statistically more likely to	92% (n = 11) of teachers completed the follow-up questionnaire. 73% (8) used background information in the Risk Watch folders. 91% told the children about the safety rules. 80% (8) of teachers modified lesson plans. 36% (4) used materials from

	Questionnaires were different for age year group as topics covered varied. Safety skills were assessed in a random sample of eight children from each school through observations of role-play in three age-appropriate injury scenarios. Children in years 3 and 4 were asked to demonstrate the 'stop, drop and roll' and those in year 5 were asked to demonstrate what to do in a domestic fire. Postal questionnaires were sent to teachers of intervention classes asking about which topics they taught, teachers views on teaching Risk Watch, usefulness of the materials and training, use of activities involving pupils parents and involvement of local organisations.	age 8 = 9.3%, age 9 = 5.4%, age 10 = -3.8% (p=.04)).		self-report never playing with matches (p = .03) (OR 1.84 (95% CI 1.06 to 3.20), p=0.03).	the Risky Boxes. 46% (5) used outside organisations to support teaching. 27% (3) gave children exercises to conduct at home with their parents. 9% (1) organised activities outside school premises.
***Lamb et al. (S1)** 2006	Performance (practice): An eight-roomed building beside a road was used to provide real-life equivalents of the Lifeskills training set. Children were given 3 minutes for each safety skill included, observed individually for assessment by a Lifeskills guide and a trained assessor blinded to the group of the	Intervention children passed a significantly higher number of knowledge tests than those in the control group (p<.001, mean number of tests passed intervention = 2.60, control = 0.79).	-	Intervention children passed a significantly higher number of performance tests than those in the control group (p<.001, mean number of tests passed intervention = 1.91, control = 0.93).	No main or interaction effects for gender or school achievement.

	child. Assessment was checked against a coding sheet. Knowledge: A pictorial task was also used. Children were asked to place the series of actions presented in the correct order for fire safety. For kitchen safety, children were asked to circle the hazards. Five pictures were used There was a three month gap between tuition and testing for the intervention group. Control group made their Lifeskills visit after testing.	By test those in the intervention group scored significantly higher in the knowledge tests for 'gas - should do' (p<.05) , 'gas - never do' (p<.01), 'fire escape route' (p<.001) and 'kitchen hazards' (p<.05).		By test those in the intervention group scored significantly higher in the performance tests for 'gas - should do', 'gas - never do' and 'fire escape route' compared to control (p<.01), but not for 'kitchen hazards' where both groups scored over 80%.	
***Lamb et al. (S2)** 2006	Same pictorial test as above. Intervention students were tested directly prior to intervention delivery, and directly following intervention delivery at Lifeskills. Control students were tested in their school. All participants completed the retention test three months later in their school.	Following mixed design ANOVA analysis a main effect was reported for intervention (intervention/control) (p<.001), time (pre/ post/ retention) (p.001) and an interaction effect for intervention x time (p<.001). Both groups started at a similar level for mean number of tests passed at pre-intervention (intervention = 0.76, control = 0.86), though the intervention group improved dramatically post intervention (2.93, 1.04) and	-	-	-

	sustained the increase over 3 months (2.09, 0.89). By individual test the intervention group outperformed the control group for 'gas - should do' (p<.001), 'gas - never do' (p<.001), 'kitchen hazards' (p<.01) and 'fire escape routine' (p<.001) for intervention x time for percentage of children correct on all features by test. Gender had one main effect - across intervention and control groups females did better than males on identifying kitchen hazards. Those from high achievement school did better than those from low achievement schools in both the fire escape routine and kitchen hazards. A differential impact was reported for the Lifeskills intervention according to school achievement; with intervention school children improving immediately post-intervention for gas - should do and gas - never do, but at	

		retention there was a greater decline in knowledge among intervention children from lower achieving schools ($p<.05$).			
Lehna et al. 2013	Three grade specific knowledge evaluation tests were designed and used. Knowledge tests were adapted from general injury prevention topic tests and reviewed by injury prevention experts. Teacher instructions were provided for each test. The same test was used both pre and post intervention delivery. One point was awarded for each correct answer in all three tests. Kindergarten test – 10-items. The nursing student tester would read aloud the question and the students were asked to circle one of two pictures. 1st/2nd grade – 12-items. The nursing student tester would read aloud the question and two possible answers, the students were asked to circle one of the two answers.	1st/2nd grade showed a significant difference between mean pre- and post-intervention test score results from 11.45 to 11.83 ($p<.001$). Though results were not statistically significant for the kindergarten (8.33 to 8.5, $p = 0.406$) and 3rd/4th grade (9.31 to 9.39, $p = 0.636$) groups.	-	-	Paper reports that students in all three age groups loved the Hazard House program. They attentively listened, and interacted with the intervention, though some of the younger students were frightened of the firefighter with all their kit on. Paper also reports that during the intervention that the older students engaged well with the questions during the intervention and knew all the answers – therefore their knowledge levels have already been high.

	3rd/4th Grade – 12-items. Students independently read the questions and either wrote an answer or circles a letter indicating their response. Post-intervention tests were conducted immediately following intervention delivery. Unit of measure = grade				
Mondozzi 2001	Pre-test consisted of a 10 question multiple choice test (approx. 10 – 15 mins). Post-test consisted of a 10 question multiple choice test, completed 1 day to 1 week following intervention delivery. The same concepts were tested in both the pre- and post-tests, though questions differed. All data collected were from a non-random sample from The Firefighter's Game. Data used for analysis used only those who contributed pre- and post-tests. A game evaluation questionnaire was completed by the instructor with items on content, quality and effectiveness.	8 2nd grade (n = 161), and 5 4th (n = 177) grade classes returned complete data. This equates to 33% of all returned data. Statement made that all 2nd and 4th grades showed significant improvement in test scores. 161 2nd grade students completed the pre-test, 159 the post-test with a range of 8 – 40% improvement across classes; equating to a range in 0.64 – 2.68 improvement in mean test scores. 177 4th grade students completed the pre-test, 175	-	-	Strong limitations noted with regards to returned data. It is documented that some classes omitted the pre- or post-test data. Some teachers administered the tests as a group in an oral fashion, and one group used the pre-test both before and after the game. Results state ' All groups, whether 2nd or 4th grade, showed significant improvement in test scores' though no values are presented in association with

		the post-test with a range of 7 – 51% improvement across classes' equating to a range in 1.07 – 2.14 improvement in mean test scores.			significance and no explanation of statistical tests performed to test significance are reported. 15 instructor evaluations were returned – 100% of instructors endorsed the games for clarity, ease of implementation and student understanding of concepts. 65% suggested that student interest in the games was excellent and 33% good. Instructors reported that some questions evoked high levels of interest and that the colourful and encouraging nature excited children about learning safety rules.
Morrongiello et al. 2012	Children were presented with 19 hypothetical fire scenarios using a dollhouse and then demonstrated	A significant increase reported for the intervention group from pre- to post-intervention	-	-	No parents reported having difficulty using the game. On average

	their knowledge of key messages by using figures to act out how they would respond. The children finished the story with the figurines. Two key messages were tested using photos. Children were asked to answer questions relating to the events depicted in the photo. Questions were the same both pre- and post-intervention though question order was randomised. Sessions were recorded for later coding of responses. Scores were attributed to obtain a summary knowledge and behaviour score. Parents filled in diary recording sheets each time the game was played by the child – number of minutes played, whether the child played alone or with a parent, whether the child enjoyed played the game and how the game could be expanded or improved.	testing in overall correct score across time (p<.01); no significant change in overall percent correct score across time for the control group (p>.05). When analysed separately there were no significant differences between groups in their overall percent correct score at pre-intervention (p>.05), but the overall correct score for children in the intervention group was significantly higher than control at post-intervention (p<.01). Main effects of time (p<.001), group (p<.01), scenario (p<.10) and a group x time interaction (p<.05) were observed following a split plot analysis.			children played the game accumulatively for 45 minutes (mean length on their own = 10.33 minutes, mean length with a parent = 32.63 minutes). Parents reported that overall children enjoyed the game and that the CD format was good. A common suggestion for improvement was to increase the number of fire-safety scenarios to include those outside of the home. Results show that time spent playing the game for those in the intervention group was marginally significant with extent of increase in overall percent correct score (p<.10).
Morrongiello et al. 2016	Knowledge - A photo-sorting task was used pre- and post-intervention. Two sets of 30 photos relating to safety	81% of students in the intervention group correctly responded to verbal questions	-	-	

	scenarios/practices were used and randomly allocated per child as to which would be used pre- and post-intervention. Five photos were related to burns. Photos were separated into 'Okay to do' and 'Not ok to do' boxes. Upon completion those photos in the 'Not okay to do box' were removed and children were asked to explain why they had chosen this option. Each correctly assigned photo was assigned one point – total score transferred to percent for analysis. To evaluate program specific knowledge following each session the children individually took part in a verbal evaluation to assess knowledge from previous session (five questions specific to content covered). Audio responses were recorded and coded. Unit of measure = Individual child	relating to burn specific content the following week. A significant interaction of time x condition was reported (p<.001). For overall photo-identification scores, those in the intervention group scored significantly higher than those in the control group at post-intervention (p<.001), results were not significantly different at pre-intervention between the groups (p>.05). When assessed within the same groups across the two time-points, children in the control group did not significantly differ (p>.05), whilst children in the intervention group achieved significantly higher scores at post-intervention compared to pre- (p=.001). The intervention group also showed a significant increase from pre-post-intervention in their accuracy of identification of injury-risk behaviours (p<.001).	

		With regard to understanding of injury risk a significant difference was reported between groups post-intervention (p<.001), and within groups those in the control showed no significant change across time points (p>.05), whereas those in the intervention group showed a significant increase in understanding (p<.001).		
Sinha et al. 2011	Knowledge - multiple choice test by a show of hands for the correct answer (3 questions on burn safety) prior to intervention, and immediately after delivery. Teachers noted number of correct answers for each question at both time-points Efficacy quotient calculated as the percentage improvement, defined as 100- pre-test percentage Unit of measure = Class	Overall: Efficacy quotient = 42.8% Pre-test = 67.8% Post-test = 81.6% Significant increase from pre-test to post-test (p <.01) By question: Significant increase for questions 1 (74.6% to 89.2%, p<.01) and 2 (47.2% to 68.9%, p<.01) between pre- and post-test. No significant increase for question 3 between pre – (84.7%) and post-test (86.8%)		Efficacy quotient = 42.8% Pre-test = 67.8% Post-test = 81.6% Significant increase from pre-test to post-test (p <.01)

Appendix 35 – Results of quality assessment of studies using the Effective Public Health Practice Project's 'Quality Assessment Tool for Quantitative Studies' for 'What intervention prevention unintentional burns and scalds for school-aged children? A systematic review.'

	Selection Bias	Study Design	Confounders	Blinding	Data Collection Method	Withdrawals and Dropouts	Assigned Global Rating
Azeredo 2003	Weak	Moderate	Weak	Weak	Weak	Weak	**Weak**
Chavez 2014	Moderate	Moderate	Weak	Weak	Weak	Weak	**Weak**
Frederick 2000	Moderate	Moderate	Weak	Weak	Moderate	Moderate	**Weak**
Harre 2000	Weak	Moderate	Moderate	Weak	Weak	Moderate	**Weak**
Moore 2004	Moderate	Moderate	Moderate	Weak	Weak	Strong	**Weak**
Kendrick 2007	Weak	Strong	Strong	Moderate	Moderate	Strong	**Moderate**
Lamb 2006 (S1)	Moderate	Weak	Strong	Moderate	Moderate	Strong	**Moderate**
Lamb 2006 (S2)	Moderate	Moderate	Strong	Weak	Moderate	Moderate	**Moderate**
Lehna 2013	Weak	Moderate	Weak	Weak	Weak	Moderate	**Weak**

Mondozzi 2001	Weak	Moderate	Weak	Weak	Weak	Weak	**Weak**
Morrongiello 2012	Weak	Moderate	Strong	Weak	Moderate	Moderate	**Weak**
Morrongiello 2016	Moderate	Moderate	Moderate	Strong	Strong	Moderate	**Strong**
Sinha et al. 2011	Moderate	Moderate	Weak	Weak	Weak	Weak	**Weak**

The global ratings for papers are allocated as follows - Strong = no weak ratings, Moderate = one weak rating, Weak = two or more weak ratings

Appendix 36 – Learn About Burns intervention descriptive account of lesson one (prevention)

Starter Activity (2 minutes) [Slides 4 - 6]
The starter activity will introduce the students to what burns and scalds are, and why they are important in a question and answer format.

Development Activities (29 minutes)
Burn awareness (6 minutes) [Slides 7 - 10]
The burn awareness activity will start with a small group activity asking the students to think about the different ways that people can burn themselves. Results will be fed-back to the class as a whole-group. A graph will then be presented to the class of the most common burn injuries to school-aged children and their mechanisms from local burn injury data. Throughout the discussion and questions it will be highlighted that the majority of burns and scalds occur to children within the kitchen whilst preparing hot food and drinks. The students will be asked if they can think of any ways that these injuries could have been avoided.

Hot things around your home (5 minutes) [Slides 11 – 13; Video 1]
Building on the previous activity it will be explained to students that injuries often occur as drinks, food and appliances stay hotter for longer than they might think. Three pictures each of a cup of tea, a pair of hair straighteners and a hot water bottle will be provided for students who wish to actively take part in the exercise. Students will be asked by a show of hands to take part. Selected students will be asked to place the picture on the timeline at the point where they think their object will have cooled down enough not to cause a burn or scald injury. Specially filmed and edited thermal imaging videos will then be used to answer the question. The videos will provide the image of the object and a temperature scale in a time-lapse format with a large clock indicating the time that has passed. Following the videos students will be asked to make appropriate edits to the timeline if necessary.

Making a hot drink (6 minutes) [Slides 14 – 16; Video 2]
A video will be shown of a child safely making a hot drink with a voiceover of the appropriate steps providing positive role-modelling for the students. The trainer will invite two students to the front of the class. One student will be asked to demonstrate how much a kettle should be filled to make one hot drink using water from a jug with coloured dye in it. The second student will then be asked to run through the safety practices and prevention messages for making a cup of tea and demonstrate how to safely pour the water from the kettle into a glass mug. A third student will then be asked to mimic a spill of the mug onto a white material sheet (mimicking clothing) and to measure with a ruler the furthest distance the liquid reaches to demonstrate possible extent of scald from a hot drink due to how far the hot liquid can go.

Filling a hot water bottle (5 minutes) [Slides 17 - 19; Video 3]
A video will be shown of a child safely filling a hot water bottle with a voiceover of the appropriate steps providing positive role-modelling for the students. The trainer will invite one student to the front of the class. The student will be asked to demonstrate how to run through the safety practices and prevention message for filling a hot water bottle and demonstrate it using cold water coloured with food dye from the kettle. Through the use of food dye any split water will be more noticeable to the students indicating how careful they need to be and how easily a scald could occur.

How to take something hot out of the microwave (4 minutes) [Slides 20 -22; Video 4]
A video will be shown of a child safely removing heated food from the microwave with a voiceover of the appropriate steps providing positive role-modelling for the students. The trainer will discuss safety points and prevention messages with the students in a question

answer format highlighting the need to protect your hands if you are going to touch anything hot.

Other risks in the kitchen (3 minutes) [Slide 23]
Five images will be shown to the students (a hot pan boiling on the stove, an oven door, a dishwasher, a toaster and an iron). The trainer will ask the students in small teams (approximately 4 to 5 per group) to think about how these objects/appliances might burn them, or any younger siblings and how they might avoid these burns or scalds in a question and answer format.

Round-Up (4 minutes) [Slides 24 - 25]
Students will be asked to come up with their own three prevention message from what they had learnt today. The three messages will start with the word 'Always…' forming 'The Three A's' (section xx). Student's ideas will be fed back to the trainer who will then provide their set of examples. Students will be offered a magnet sized piece of paper to document their own three A's and place their name on the back. These will be taken home by the trainer, laminated and returned to students to take home at the end of the second lesson with their first-aid magnets to be stuck on the fridge.

Appendix 37 – Learn About Burns intervention descriptive account of lesson two (first-aid)

Starter Activity (5 minutes) [Slide 3]
In pairs the trainer will provide students with an outline of a house [Appendix xx] and ask them to fill in as many of the burn agents and mechanisms that they can remember from the first lesson. Students will then be asked to feedback their responses. The trainer will then ask the students to tell them what safety and prevention messages they remember. If any have been forgotten these will be highlighted in a question and answer format.

Development Activities (22 minutes)
Introduction to burns first-aid (2 minutes) [Slides 4 – 7]
The trainer will introduce the topic of first-aid in a question and answer format answering the questions relating to what first-aid is, why it is important and whether children can learn first-aid and help. The following details the main points to be covered in answering each question.

- What is first-aid? First-aid is help given to a sick or injured person until full medical treatment is available
- First-aid includes: Staying safe, looking out for danger, helping someone feel better and call, and getting help (either by telling an adult or calling the emergency services)

Why is first-aid important?
- It can make a difference
- Everyone should help each other
- The people you are most likely to help are your friends and family

Can children learn first-aid?
- Yes!
- Everyone can learn how to give first-aid and be able to help someone
- So… children can learn first-aid too

Why is first-aid important if someone has a burn injury?
- The faster you can help, the less likely they are to have a scar on their skin
- It can help to take some of the pain away
- It will help to keep the injury clean and reduce the chance of someone being poorly from an infection

Cool, Call, Cover timeline (20 minutes) [Slides 8 – 16]
The trainer will explain to the students that during burns first-aid they should use three simple steps. These steps are – Cool, Call, Cover.

Cool

The trainer will explain to the students how and why we use cold running water for the treatment of burns. The trainer will ask students to think and provide suggestions/answers of where they might be able to access cold running water in their home. As an aide to this exercise the trainer will have a physical prompts box which contains inside: a tap, a shower head and a piece of hose pipe. These can be revealed as the students suggest the correct sources or used as prompts to guide their answers if not.

The trainer will explain to the students that it is important to cool the burn for a certain amount of time. A large-scale paper timeline (from lesson one) will be presented to the class. The trainer will ask three volunteers to place a picture of a blue tap picture next to how long they think you need to cool the burn for. The trainer will explain that a burn should be cooled for 20 minutes to try and take all the heat out of the skin that has been burned – if you do not remove the heat the injury can become worse. A student volunteer will be asked to amend the timeline to show the appropriate amount of time. A large clock will be set-up on a desk and a volunteer given the job to inform the class when it has been 20 minutes (the lesson will carry on). When the student informs the class that it has been 20 minutes the trainer will emphasise to the students that although it seems to be a long time that it is really important to cool a burn for 20 minutes.

The trainer will explain to the students that it is important to remove all clothes and jewellery close to the burn injury site. The explanation provided will describe how clothes must be removed to stop any fabric from sticking to the burn, and jewellery must be removed as the injury may cause the skin to swell and get bigger quite quickly so the jewellery may get stuck.

On the PowerPoint slide the guidelines associated with 'Cool' will be presented to the students.

Call

The trainer will remind students of how serious burn injuries are and that if they are on their own that they should call for help. It will be explained to students that there are different people to call for help depending on the burn injury. A PowerPoint slide will be used to explain when and how to call 999, 111, a General Practitioner (GP) or an adult. It will be explained to students that if they are ever on their own, or with friends/siblings and without an adult that they should call an adult for help. It will be explained to students that a call to 999 should only be made if they are on their own, for any burns that are bigger than the casualty's hand, it is on the face, hands, feet or genitals or if it is very deep. If the students are on their own but the burn is smaller than the casualties hand, is not on the face, hands, feet or genitals, and is not very deep then they should call 111 or their GP.

The trainer will explain that if a serious burn accident occurs and a student feels that they should call 999 then there are questions that the emergency services will ask them. The questions will be provided on a PowerPoint slide and individually read allowed by the trainer. The trainer will provide a brief scenario of a burn injury and

ask two students to volunteer to act out the call – one as the caller and one as the emergency services operator.

The trainer will remind the students that it is not appropriate to ring the emergency services when it is not a true emergency.

On the PowerPoint slide the guidelines associated with 'Call' will be presented to the students.

Cover

The trainer will provide an explanation of why it is important to cover burns. An explanation of how and what to use will be provided. An explanation that it is inappropriate to use 'lotions and potions' will also be provided. The explanation will cover the following points –

- It can help take some of the pain away
- It can help to keep the burn clean and help stop infection
- It is important to use a clean non fluffy dressing such as cling-film, a clean plastic bag or a sandwich bag
- Fluffy dressings (such as tissue, a flannel or cotton pads) should not be used as the fibers can get stuck in the wound
- A clean non-fluffy dressing should be applied loosely to the burn and layered
- No 'lotions and potions' should be used as they can make the burn injury worse by keeping the heat in and killing the good cells that are trying to help your skin heal

The trainer will ask a student volunteer to help them in a practical demonstration of how to appropriately and carefully cover a burn with cling film and a clean plastic bag. The trainer will provide each table or small group of students with a box containing common household materials. In pairs the trainer will ask students to select an appropriate material to use and carefully show how they would cover their partner's hand or arm.

The guidelines associated with 'Cover' will be presented to the students on the PowerPoint slide.

A video will be shown of a child providing appropriate burns first-aid with a voiceover of the appropriate steps providing positive role-modelling for the students.

Round-Up (6 minutes) [Slide 17; Video 5]

The children will be shown a video of a child providing appropriate burns first-aid with a voiceover of the appropriate steps providing positive role-modelling for the students.

All prevention messages and the cool, call, cover guidelines will be repeated.

Students will be provided with a certificate and a sticker congratulating them on completing the 'Learn About Burns' Program, a fridge magnet containing the 'Cool, Call, Cover' guidelines and a laminated copy of their Three A's prevention messages. Where possible and appropriate certificates will be awarded as part of the schools presentation or award ceremony by the Head Teacher; if not then they will be awarded by the trainer following culmination of intervention delivery.

Appendix 38 – Learn About Burns intervention lesson plan one (prevention)

Learn About Burns: Lesson Plan 1 – Prevention

Learning Objectives

By the end of the lesson, pupils will be able to:	• Understand the difference between a burn and a scald • Recognise different ways that children could burn themselves at home • Understand and be able to act upon key prevention messages for common household burns

Activities

Activity	Key Messages	Timing	Resources
Starter Activity What are burns? • Introductory Presentation – What is a burn? What is a scald? Why are they important?		2 minutes	PowerPoint
Development Activities *Burn Awareness* • Split the class into small groups. With a pen and one piece of paper ask them to write down as many ways they can think of that someone could burn themselves • Feedback responses • Describe/explain the most common burn injury objects with a graph and discuss the mechanisms of injury • Ask the children to think of how they might avoid these injuries	• The majority of burns happen in the home during food preparation caused by spilling hot liquids and touching hot objects	6 minutes	PowerPoint, Paper & Pens

Hot things around your home • Describe/explain that the most common burn injury objects stay hot for a very long and so could burn you when you think they might be cool • Ask children to mark on the timeline how long they think it will take for the cup of tea, the hair straighteners and the hot water bottle to cool down • Show the thermal imaging videos • Make adjustments to the timeline if necessary	• A cup of tea could still burn after 20 minutes • A pair of hair straighteners could still burn after 30 minutes • A hot water bottle could still burn after 5 hours	5 minutes	
Making a Hot Drink • Show how to safely make a hot drink video • Invite a pupil to demonstrate how much water (from jug) they would put into the kettle if they were making one cup of tea • Invite a pupil to safely demonstrate how to slowly and carefully pour cold water containing dye from a kettle into a glass mug Talk through the safety and prevention messages. • Invite a pupil to mimic spilling the mug onto a white material sheet - ask the pupil to measure the longest distance the water has gone.	• Always ask permission from an adult • Always get everything you need out of the cupboards before you start • Only use the amount of water that you need • Never lean over the kettle when it is turned on • When the kettle has boiled wait until the steam has gone before picking it up • If it is too heavy for you to carefully pick it up then ask an adult for help • Pour the water carefully, slowly, near the cup and away from you avoiding the steam • Never hold the cup as you pour the water • Make sure the cup is on a steady and flat surface • Stir the drink carefully and slowly • A little amount of hot liquid can go a long way	6 minutes	PowerPoint, Kettle, Hot Water Bottle, jug of coloured water, water & glass mug, white material sheet, ruler

Filling a Hot Water Bottle • Show how to safely fill a hot water bottle video • Invite a pupil to safely demonstrate how to slowly and safely fill a hot water bottle with cold water containing food dye. Talk through the safety and prevention messages.	• Always ask permission from an adult • Only the amount of water that you need (normally 4 cups) – you should only fill your bottle ¾ of the way • Make sure the bottle is not damaged – check for holes or thin areas • Never lean over the kettle when it is turned on • When the kettle has boiled wait until the steam has gone before picking it up • Place the empty hot water bottle lying flat in the sink – turn the spout up and pour the water slowly and carefully into the hole • Carefully lift the hot water bottle and make sure there is no air in the top • Twist the stopper into place making sure that it is tight – always ask an adult to check for you • Dry the outside of the bottle and place it into a cover – never put the plastic directly next to your skin or sleep with a hot water bottle	5 minutes	

How to take something hot out of the Microwave • Show how to take something out of the microwave video • Discuss with children the safety points and prevention messages	• Always an adults permission • Read the instructions carefully and cook for the required time – if you are unsure ask an adult to help you • When it has finished cooking let the food rest for a few minutes before opening the door • Always use protection for your hands if you are going to touch something hot • If the dish is too hot or heavy then ask an adult for help • Let the dish cool on the side for a few minutes before trying to carry or move it anywhere	4 minutes	
Other risks in the kitchen • Show pictures of other kitchen appliances that can cause burns and scalds in the kitchen: hot pan boiling on the stove, oven door, dishwasher, toaster and an iron. Ask the pupils to think about how these things might burn them and how they might avoid these burns	• Never lift anything that is too heavy for you, always ask an adult for help • Always turn pot handles sideways • Never touch the front of an oven door • Always wait a few minutes after the dishwasher has finished to open the door avoiding the steam • Never touch the side of a toaster • If you can't get your toast out always ask an adult for help • Never touch the silver side of an iron or go near the steam	3 minutes	

	• Never leave an iron cooling down where someone could bump into it		
Round-Up *The Three A's* • Ask the children to come up with their own three prevention messages from what they have learnt today. All to start with 'Always…' Ask them to feedback their answer and provide set examples Show round-up video	• Always ask an adults permission • Always be very careful around hot water and steam. Remember if you can't lift or pour it safely ask an adult for help. • Always protect your hands if you are going to touch something hot	4 minutes	PowerPoint

Appendix 39 – Learn About Burns intervention lesson plan two (first-aid)

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Learn About Burns: Lesson Plan 2 – First Aid

Learning Objectives

By the end of the lesson, students will be able to:	• Recognise when someone has a burn or a scald • Respond appropriately to someone who has a burn or a scald • Understand when, and who, to call for help

Activities

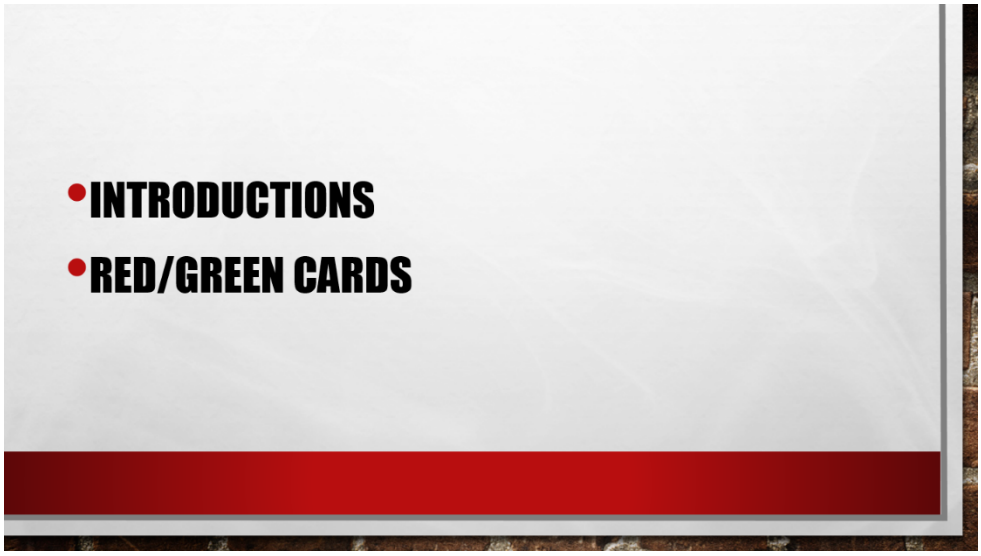
Activity	Timing	Resources
Starter Activity Prevention Recap • In pairs provide students with outline of house used in lesson 1 - the children can fill-in as many of the common burn agents as they can remember in the different areas • Feedback on the agents that they remember • Ask what prevention messages they can remember	3 minutes 1 minute 2 minutes	PowerPoint, Blank house diagrams, pens
Development Activities Introduction to Burns First Aid • What is first aid? • Why is it important? • Can we help?	3 minutes	PowerPoint
Cool, Call, Cover Timeline Cool • Explanation provided of how and why we use cold running water to cool burns. Students asked to think of what clean cold water sources they can think of in their home. Physical prompts of cold water sources will be provided and revealed – a tap, a shower head and a piece of hose pipe • Explanation provided of why clothes and jewellery should be removed	18 minutes	PowerPoint, a tap, a shower head, a hose pipe
Call • Explanation of when and who to call for help • Discuss common questions that will be asked if you ring for an ambulance • Practical with two students at the front of the class – one being the caller and one the		PowerPoint, dummy phones

emergency response officer • Explanation of the importance of not calling the emergency services if it is not an emergency Cover • Explanation of why we need to cover burns • Explanation of how and what we use to cover burns and why we don't use lotions and potions • Boxes of common household materials provided on each table – in pairs students have to select an appropriate material from the box and use it to carefully cover their partners hand or arm		PowerPoint, boxes of household materials
Round-Up Activity <u>First Aid Video</u> • Show the video • Repeat all prevention messages and cool, call, cover guidelines <u>Goodbye</u> • Thank the students for their time and open up the floor to any last questions <u>*Take home materials*</u> • Take home materials are to be passed to teachers for presentation by in a school assembly. If this option is not available materials are to be passed directly to students	6 minutes	PowerPoint Certificate of completion, first-aid fridge magnet and Three A's (one per student)

Appendix 40 – Learn About Burns intervention PowerPoint presentation one (prevention)

1.

2.



3.


WHAT ARE WE GOING TO LEARN ABOUT?
• WHAT A BURN IS AND WHY THEY ARE IMPORTANT
• HOT THINGS AROUND YOUR HOME
• SAFETY AND FOOD PREPARATION

4.


WHAT IS A BURN?
AN INJURY CAUSED BY EXPOSURE TO HEAT OR A FLAME

5.

WHAT IS A SCALD?

AN INJURY CAUSED BY HOT LIQUID OR STEAM

6.

WHY ARE THEY IMPORTANT?

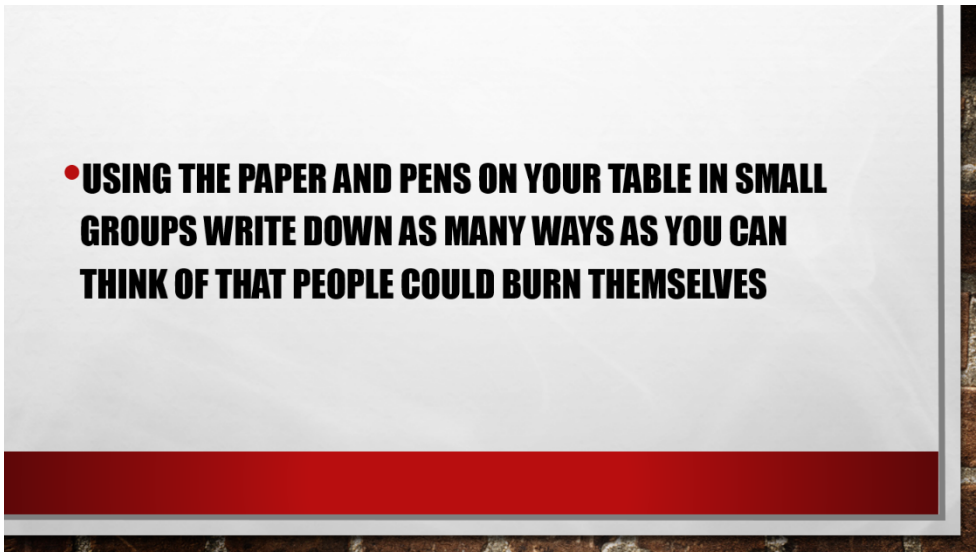
BURNS AND SCALDS CAN CAUSE DAMAGE TO YOUR SKIN

NOT ONLY DOES IT REALLY HURT YOUR SKIN BUT THEY CAN LEAVE SCARS

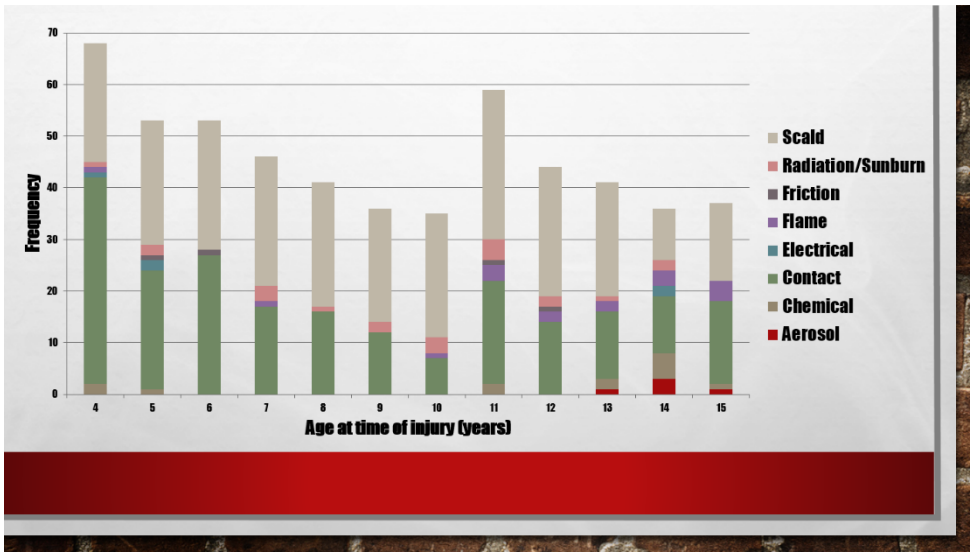
SOME SCARS LAST FOR LIFE

BURNS ARE COMMON INJURIES FOR CHILDREN YOUR AGE

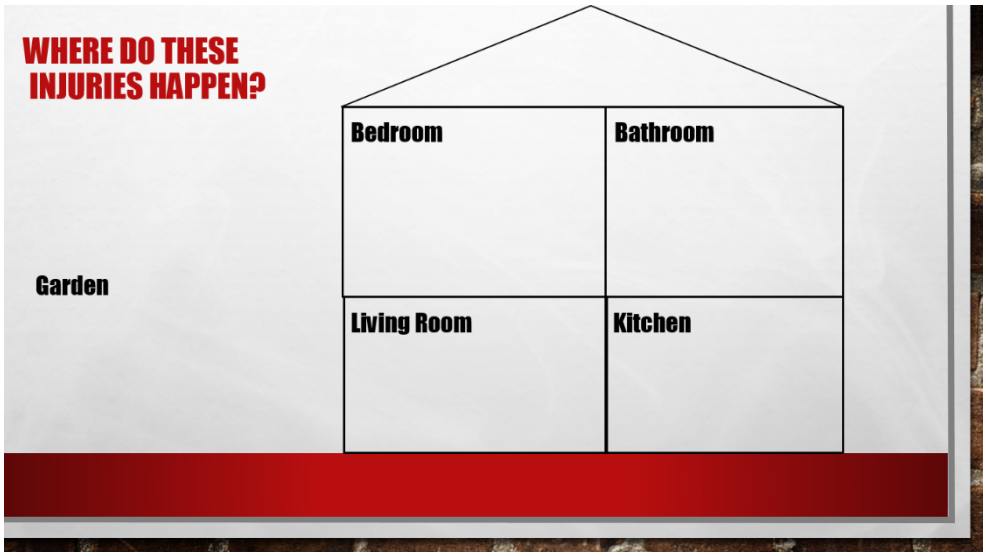
7.


USING THE PAPER AND PENS ON YOUR TABLE IN SMALL GROUPS WRITE DOWN AS MANY WAYS AS YOU CAN THINK OF THAT PEOPLE COULD BURN THEMSELVES

8.


Frequency
70
60
50
40
30
20
10
0
4
5
6
7
8
9
10
11
12
13
14
15
Age at time of injury (years)
Scald
Radiation/Sunburn
Friction
Flame
Electrical
Contact
Chemical
Aerosol

9.


WHERE DO THESE INJURIES HAPPEN?
Bedroom
Bathroom
Garden
Living Room
Kitchen

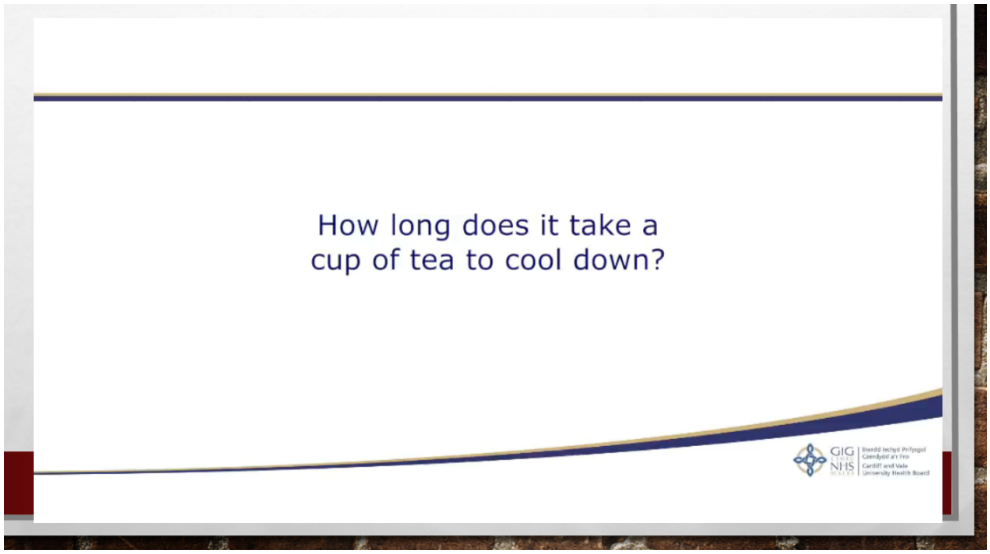
10.


HOW DO YOU THINK WE CAN STOP THEM FROM HAPPENING?
PREVENTION AVE
THIS WAY

11.


HOW LONG DO THINGS STAY HOT FOR?
A CUP OF TEA
A PAIR OF HAIR STRAIGHTENERS
A HOT WATER BOTTLE

12.


How long does it take a
cup of tea to cool down?

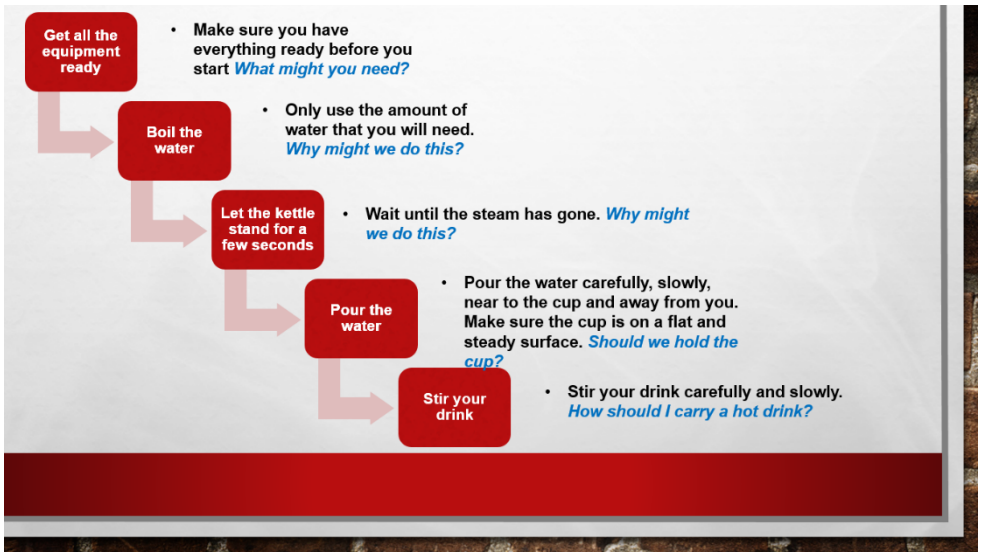
13.

How long does it take
hair straighteners to cool down?

14.

HOW TO SAFELY MAKE A HOT DRINK

15.


Get all the equipment ready
Make sure you have everything ready before you start What might you need?
Boil the water
Only use the amount of water that you will need. Why might we do this?
Let the kettle stand for a few seconds
Wait until the steam has gone. Why might we do this?
Pour the water
Pour the water carefully, slowly, near to the cup and away from you. Make sure the cup is on a flat and steady surface. Should we hold the cup?
Stir your drink
Stir your drink carefully and slowly. How should I carry a hot drink?

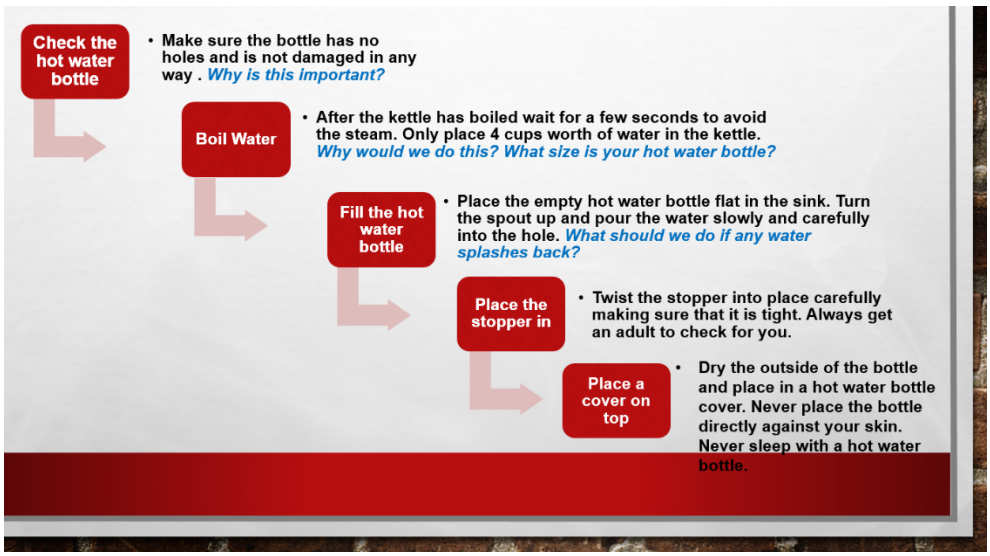
16.


How to safely make a hot drink

17.


HOW TO SAFELY FILL UP A HOT WATER BOTTLE

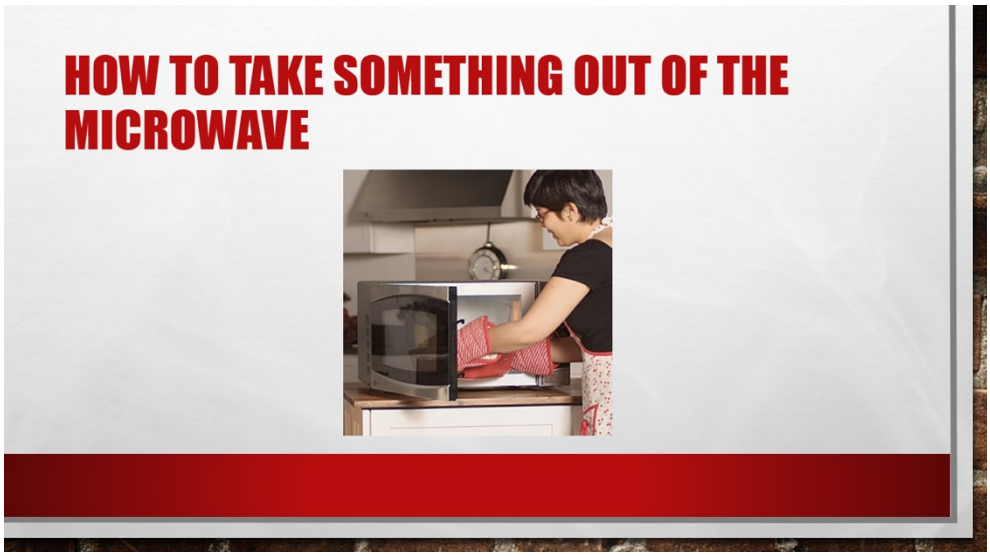
18.


Check the hot water bottle
• Make sure the bottle has no holes and is not damaged in any way . Why is this important?
Boil Water
• After the kettle has boiled wait for a few seconds to avoid the steam. Only place 4 cups worth of water in the kettle. Why would we do this? What size is your hot water bottle?
Fill the hot water bottle
• Place the empty hot water bottle flat in the sink. Turn the spout up and pour the water slowly and carefully into the hole. What should we do if any water splashes back?
Place the stopper in
• Twist the stopper into place carefully making sure that it is tight. Always get an adult to check for you.
Place a cover on top
• Dry the outside of the bottle and place in a hot water bottle cover. Never place the bottle directly against your skin. Never sleep with a hot water bottle.

19.


How to safely fill-up a
hot water bottle

20.


HOW TO TAKE SOMETHING OUT OF THE MICROWAVE

21.


Read instructions carefully and cook for the required time
• Always ask for an adults help if you are unsure
Let the food rest for a few minutes after it has finished cooking
• Always leave the food time to cool before opening the door
Use protection for your hands when removing the dish
• Always protect your hands if you are going to touch something hot. What might we use? Never touch a dish which you think you cannot move easily or is too hot
Let the dish cool on the side before trying to move it
• Never try to carry a dish that is still warm. Why do you think this is important?

22.


How to safely take something
out of the microwave

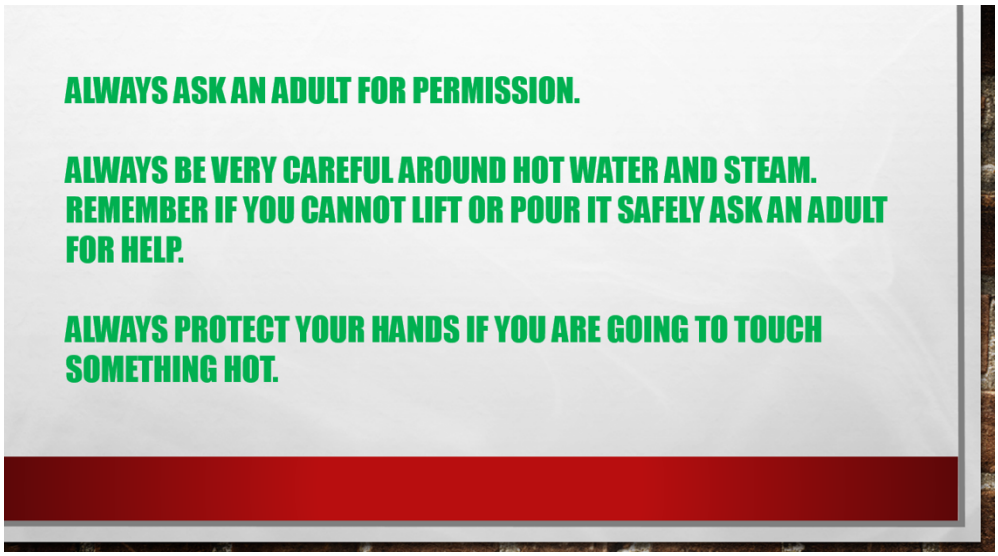
23.


OTHER RISKS IN THE KITCHEN

24.


THE THREE A'S
Using the small slips of paper on your desk write down your own three prevention rules starting with always
ALWAYS...
ALWAYS...
ALWAYS...

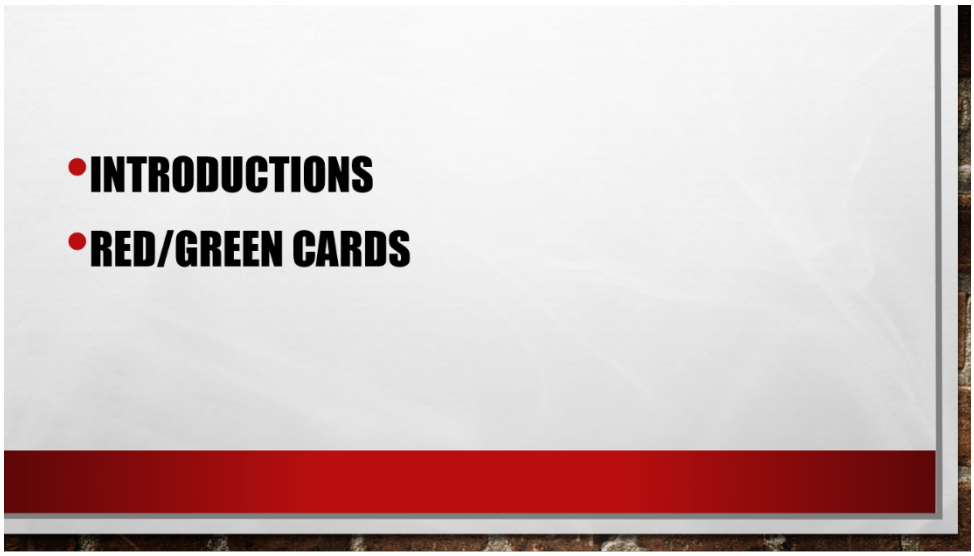
25.


ALWAYS ASK AN ADULT FOR PERMISSION.
ALWAYS BE VERY CAREFUL AROUND HOT WATER AND STEAM. REMEMBER IF YOU CANNOT LIFT OR POUR IT SAFELY ASK AN ADULT FOR HELP.
ALWAYS PROTECT YOUR HANDS IF YOU ARE GOING TO TOUCH SOMETHING HOT.

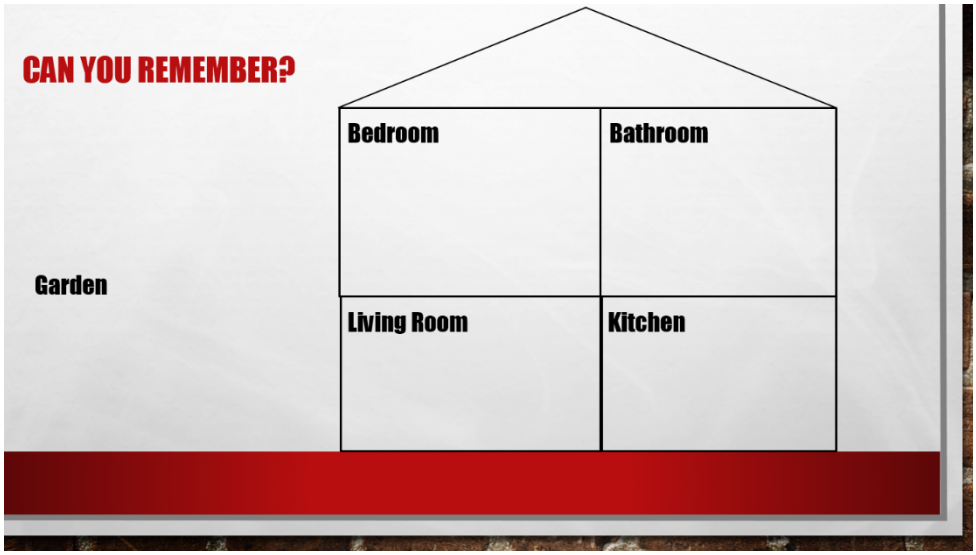
Appendix 41 – Learn About Burns intervention PowerPoint presentation two (first-aid)

1.

2.



3.


CAN YOU REMEMBER?
Bedroom
Bathroom
Garden
Living Room
Kitchen

4.


WHAT IS FIRST AID?
HELP GIVEN TO A SICK OR INJURED PERSON UNTIL FULL MEDICAL TREATMENT IS AVAILABLE
FIRST AID INCLUDES:
✓ STAYING SAFE
✓ LOOKING OUT FOR DANGER
✓ HELPING SOMEONE FEEL BETTER AND STAY CALM
✓ GETTING HELP – EITHER BY TELLING AN ADULT OR CALLING THE EMERGENCY SERVICES

5.

WHY IS FIRST AID IMPORTANT?

- IT CAN MAKE A DIFFERENCE
- EVERYONE SHOULD HELP EACH OTHER
- THE PEOPLE YOU ARE MOST LIKELY TO HELP ARE YOUR FRIENDS AND FAMILY

6.

CAN WE HELP?

YES!

EVERYONE CAN LEARN HOW TO GIVE FIRST AID AND BE ABLE TO HELP SOMEONE

SO…CHILDREN CAN LEARN FIRST AID TOO!

7.

FIRST AID AND BURNS

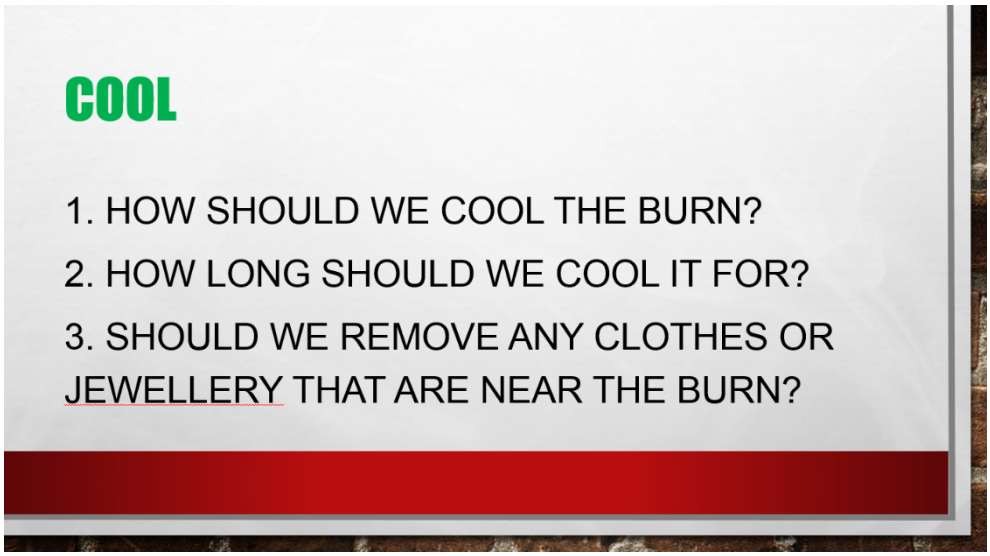
- THE FASTER YOU ARE ABLE TO HELP, THE LESS LIKELY THEY ARE TO HAVE A SCAR ON THEIR SKIN
- IT CAN HELP TO REDUCE THE PAIN
- IT WILL HELP TO KEEP IT CLEAN AND REDUCE THE CHANCE OF INFECTION

8.

THE THREE C'S!

Cool → Call → Cover

9.


COOL
1. HOW SHOULD WE COOL THE BURN?
2. HOW LONG SHOULD WE COOL IT FOR?
3. SHOULD WE REMOVE ANY CLOTHES OR JEWELLERY THAT ARE NEAR THE BURN?

10.


Cool
Call
Cover
• Cool the burn for 20 minutes with cool running water.
• Remove any clothing or jewellery near the burn
20 min.

11.

CALL

1. WHO SHOULD WE CALL FOR HELP?
2. WHEN SHOULD WE CALL FOR HELP?

12.

COMMON QUESTIONS ASKED BY THE EMERGENCY SERVICES

- WHAT SERVICE DO YOU NEED?
- WHICH TELEPHONE NUMBER ARE YOU CALLING FROM?
- WHAT IS YOUR NAME?
- WHAT ADDRESS ARE YOU CALLING FROM?
- CAN YOU TELL ME WHAT HAPPENED?
- IS THE PERSON CONSCIOUS OR UNCONSCIOUS? – CAN YOU TALK TO THEM?

13.


IT IS VERY IMPORTANT THAT YOU ONLY RING 999 IN AN ACTUAL EMERGENCY

14.


Cool
Call
Cover
• Cool the burn for 20 minutes with cool running water.
• Remove any clothing or jewellery near the burn
• Call for help – tell an adult or call 999
20 min.
999
EMERGENCY

15.


COVER
1. WHAT CAN WE USE TO COVER A BURN?
2. HOW SHOULD WE COVER IT?
3. WHY SHOULD WE COVER IT?

16.


Cool
Call
Cover
• Cool the burn for 20 minutes with cool running water.
• Remove any clothing or jewellery near the burn
• Call for help – tell an adult or call 999
• Cover with cling film or a clean non-fluffy dressing.
• Make sure the patient is kept warm
20 min.
999
EMERGENCY

17.

Appendix 42 – Learn About Burns curriculum mapping document for The Welsh National Curriculum, The National Strategy for Social and Emotional Aspects of Learning – Cymru themes and The Welsh Network of Healthy School Scheme of safety

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

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Curriculum Mapping – Learn About Burns

The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

To ensure the easiest possible integration of the program for your school the 'Learn About Burns' program has been mapped to The Welsh National Curriculum, The National Strategy for Social and Emotional Aspects of Learning themes and The Welsh Network of Healthy School Schemes theme of Safety.

Please find the appropriate information below. If you have any further questions or comments do not hesitate in contacting Harriet Quinn-Scoggins via phone on 029 2068 7945 or by email at *Quinn-ScogginsHD@Cardiff.ac.uk*

Welsh National Curriculum

	Key Stage 2 Links
Personal and Social Education Framework	Developing Thinking - 1, 3, 4 Developing Communication - 1, 2, 3 Developing Number - 1 Working With Others - 1, 2, 3, 4, 5, 6 Improving Own Learning – 1, 4 Health and Emotional Well-being - 1, 2, 6, 7, 9
Mathematics	Developing Numerical Reasoning - 1, 2, 4, 6, 15 Use of Number Facts and Relationships – 1, 2 Time - 1, 3, 5, 7 Temperature - 1
Science	Communication – 3 Enquiry – 2, 5, 7 Developing – 4, 5, 7 Reflecting - 6
English	Speaking – 1, 6 Listening - 1, 2 Collaboration and Discussion – 1, 2, 3 Comprehension – 3 Structure and Organisation – 4
Skills Framework	Developing thinking across the curriculum Developing communication across the curriculum Developing number across the curriculum

Social and Emotional Aspects of Learning – Cymru
National Strategy for Social and Emotional Aspects of Learning themes

Focus of the Theme	**Relation of Theme Focus to Program**
Theme 1 - New Beginnings	
Focuses on empathy, self-awareness, social skills and motivation	Opportunity for pupils to see themselves as valued individuals who have important first aid knowledge and skills that can actually make a difference. Self-efficacy is a focus throughout.
Theme 2 - Getting On and Falling Out	
Focuses on managing feelings (with a focus on anger) and social skills	Helps pupils to develop the skills of co-operation and working together during different activities and to solve problems in real-life contexts.
Theme 4 – Going for Goals!	
Focuses on motivation and self-awareness, giving an opportunity for all pupils' abilities, qualities and strengths to be valued	Enables every pupil to learn the fundamentals of burn prevention and burns first aid treatment regardless of academic achievement. The explorative, interactive and practical teaching styles allows for a wide-range of preferred learning styles to be met and the development of others for all pupils.
Theme 5 – Good to be me	
Focuses on the exploration of feelings in the context of the child as an individual, developing self-awareness	Activities and materials provide a safe and secure arena for pupils to explore feelings as they consider how they would feel in certain situations, and what they would do. Pupils will be able to think about empathy for those who have injuries and, self-efficacy for providing help, and the importance of relaxation and calm in injury situations.

Welsh Network of Healthy School Schemes

Indicators for the Welsh Network of Healthy School Schemes National Quality Award

Safety	
Criteria	**Indicators**
Leadership and Communication	
3. Engagement with, and response to, specific local/ national initiatives and environmental issues	3.1 School takes-up opportunities offered to be involved in a range of local/national initiatives 3.2 Schools engage with and support community initiatives
Curriculum	
4. Safety covered by Foundation phase, N.C and PSE	4.1 Schemes of work identify safety, including sun safety, internet safety, first aid and safe environments, and reflect policy 4.2 Curriculum resources used reflect current guidance
Ethos and Environment	
6. Pupil Participation	6.1 Evidence of pupil involvement in the identification and evaluation of actions 6.2 Evidence of examples of safety initiatives in which pupils are actively involved 6.3 evidence of pupil involvement in simulated first aid
7. Staff Participation	7.1 Evidence of staff not in the core healthy schools team involved in programs and initiatives

Family and Community Involvement	
9. Involvement of families and community	9.2 Links made with local community organisations and business to support the safety agenda
10. Involvement and collaboration with outside statutory and voluntary agencies and individuals	10.1 Appropriate outside agencies and individuals support the development of policies, programs and curriculum 10.2 Any contribution is planned, evaluated and the work followed up

Appendix 43 - Learn About Burns feasibility study school invitation email

Dear [insert appropriate name here],

My name is Harriet Quinn-Scoggins. I am a PhD researcher at Cardiff University's School of Medicine working as part of The Children's Burn Research Network. As part of my PhD I have developed a school-based burns prevention program for Year 4 students, which I would like to test with primary schools within the Cardiff Education Authority.

The intervention has been devised because unfortunately burn and scald injuries are a common, and often preventable, problem within pre-adolescence.

- Approximately 57,000 children aged <14 attend Emergency Departments with a burn injury each year in England and Wales
- Approximately 3,750 of these will be admitted for specialist treatment, with long term risk of scarring and psychological consequences

The intervention will come at no cost to your school, with a researcher from the team delivering the program and supplying all the materials. It consists of two lessons (lasting approximately 40 minutes) covering burns prevention messages and burns first aid. One more visit would then take place three months later to assess whether the children have remembered what we taught them. The intervention has been mapped to the Welsh National Curriculum, SEAL Cymru and is approved and recognised by the Welsh Network of Healthy Schools Scheme theme of Safety.

We believe that engagement with this program, provided in an exciting way by specialists using some innovative teaching materials provides a unique opportunity for your pupils to learn life skills.

This project has been approved by Cardiff School of Medicine Research Ethics Committee, and the researcher has an enhanced DBS check 17/03/2016.

If you are interested in the study please have a look at the attached information sheet for more details, or feel free to contact me via email at Quinn-ScogginsHD@Cardiff.ac.uk or via telephone on 029 2068 7945.

Kind regards,

Harriet Quinn-Scoggins

Appendix 44 – Learn About Burns feasibility study school information sheet

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

School Information Sheet – Learn About Burns

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

If you have any further questions or comments do not hesitate in contacting Harriet Quinn-Scoggins via phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk.

What is the Study Title?
Learn About Burns

'Why has 'Learn About Burns' been developed?
Learn About Burns is a burns prevention program that has been developed by researchers at Cardiff University's School of Medicine as part of The Burns Collective sponsored by The Healing Foundation.

- Every year in the UK an estimated 57,000 children aged less than 14 years attend emergency departments with burns and scalds
- Of these 3,750 are admitted to hospital for specialist treatment
- Burn injuries can cause serious physical impairments, including scarring and disfigurement, and may have severe psychosocial and emotional costs

Although burn injuries are common, they are also preventable.

Previous research and preparatory work has highlighted:
- children lack knowledge and understanding of how they can sustain common burn injuries
- Burns are rising among children aged between 9 and 12 years as they gain independence
- children lack knowledge of burns first aid
- far too many children who attend for medical treatment have administered no or incorrect burns first aid

Because of this children are putting themselves at a higher risk of serious injury.

What are the aims of the study?

1. To assess the feasibility and acceptability of delivering a school-based burns prevention program
2. To investigate whether a school-aged burns prevention program can increase children's knowledge, attitude and self-efficacy of correct burns first aid and burn prevention messages

What data will be collected?

Aim 1 -

- We will invite yourself, and other staff members involved, to take part in a short semi-structured interview. The interview will be conducted on an individual basis by the researcher, recorded on a Dictaphone for analysis and will last no longer than 30 minutes. The interview will be used to gain insight into your experience and perceptions of the program as a whole. All such data will be anonymised for analysis.

Aim 2 -

- Pupils will be asked to provide answers to knowledge, attitude and self-efficacy questions about burns prevention and first aid at the beginning of the first teaching session, at the end of the second teaching session and on the third visit 3 months later. This data will be used to measure any changes provided by the program. Data will be collected by the researcher using 'clickers' (also known as audience response devices, as in 'who wants to be a millionaire') using multiple choice and Likert-scale styled questions. Responses will be recorded by the computer software, no individual answers or responses will be provided to the class, all data will be anonymised for analysis.
- Pupils will be asked to provide their age and gender when they first answer questions. We can use these to assess whether age and gender have an effect on how well the intervention works.

Is my school eligible to take part in this study?

To be eligible schools must meet the following inclusion criteria:

✓ Reside within the Cardiff Education Board

✓ Have a 'Year 4' class (8 – 9 years old)

✓ Be English speaking, or Bi-lingual

And not meet any of the following exclusion criteria:

- Be a welsh language school
- Have mixed year groups
- Be a school dedicated to the support and teaching of children with complex needs

What is expected of the school?

- The school will be asked to facilitate a site visit for the researcher at a time most convenient for the school. During this time any questions regarding the study process and program can be asked by the school, and consent to the study can be officiated.
- The school will be asked to distribute 'Parent Opt-Out Letters' and 'Pupil Information Sheets' (provided by the researcher) four weeks before the first session. These can be provided in an electronic or paper format, as preferred by the school.
- The researcher will collect any 'opt-out' slips that are returned to the teacher, and the school will need to provide alternative provision for those students not taking part in the study.
- The Year 4 teacher/s will be invited to have a brief telephone/ face-to-face conversation with the researcher at least one week before the first program session. During this conversation the researcher will ask the teacher to provide information on the overall atmosphere of the class teaching environment and special requirements of any of the pupils.
- The school will be asked to provide a maximum of three hours to the study per class (approximately 40 minutes on three separate occasions). The first two sessions need to be on consecutive weeks. The third session will be three months later. All teaching and data collection throughout the study will be conducted by the researcher.
- There will be no cost to the school. All materials required will be provided by the researcher.
- The school will be asked to provide a member of staff to remain with the researcher in the classroom for the duration of all three sessions.
- School staff involved with the study will be invited to take part in one short semi-structured interview with the researcher. All interviews will be individual, recorded and will last no longer than 30 minutes.
- The program has been mapped to the Welsh National Curriculum, SEAL Cymru and is recognised and approved by the Welsh Network of Healthy Schools Schemes theme of Safety.

Are there any risks involved in this study?

The study has no significant risks. However due to the nature of the content and messages precautions have been put into place in response to the sensitivity of some of the issues –

- During the conversation between the class teacher and the researcher, the teacher will provide information on pupils taking part in the research that may have difficulty with the intervention. With this knowledge the research team can address the class or individual with a higher level of sensitivity and introduce the topic at a slower pace as appropriate
- All pupils will be issued with a small piece of card – green on one side (symbolising that they are happy to carry on) and red on the other (symbolising that they are not happy to carry on). Pupils can choose to turn the card from green to red at any point during the session; this action will be addressed immediately with either a change of subject, slowing down of content or a personal discussion with the teacher or the pupil as appropriate.
- If any questions or concerns are raised by pupils to the teacher or other members of staff then the member of staff should inform the researcher as appropriate so that the question or concern can be answered or dealt with appropriately.
- All contact sessions will be conducted within the classroom environment to sustain as much normality for the pupils as possible.
- Any staff members who remain in the classroom during the program will be asked to pay attention to any non-verbal cues emitted by pupils that could be an indication of willingness to participate and comfort levels with the situation or topic. If any high levels of distress or un-comfort are recognised then the staff member should approach the researcher so that the situation can be addressed appropriately.
- All program materials have been developed with sensitivity in mind. Prevention and first-aid messages and concepts will be relayed through the materials however they will not explicitly demonstrate injury events.
- If any pupils or teachers raise concerns, worries or would like any further information on the topic of paediatric burns and prevention they will be directed to appropriate resources and support groups.

Privacy and Confidentiality

All data and personal information collected during the study will be treated confidentially and anonymously. Pupils and school staff will be issued with a unique identifier by the research team that will be used throughout the duration of the study and any research output. Direct quotations from interviews may be used in research output - quotations used will be associated with unique identifiers, quotations containing identifiable information will not be used. All data, consent forms and information sheets will be kept within a secured location accessible only to the research team. The research team will not use, discuss or share any of the enclosed information outside the remits of the study. Following study completion all data, consent forms and information sheets will be stored and disposed of in compliance with Cardiff University Data Protection Policy.

Is the study voluntary?

The study is completely voluntary on behalf of schools, staff and pupils. Schools, staff and pupils who agree to take part can decide to withdraw from the study at any time without having to provide a reason.

What about consent?

The headteacher will be asked to consent on behalf of the school to the research study. Any teaching staff who take part in an interview will be asked to sign individual consent forms. Parents will not be asked to consent their children to the research study. In-line with current standard practice for school-based studies in the UK a 'Parent Opt-Out Letter' will be provided to inform them of the study four weeks before the first session. If parents do not wish their child to take part they will be asked to return the form to the class teacher who will inform the researcher. Pupils will be asked to verbally 'assent' to the study at each contact point with the researcher (this means that all students will be asked if they are happy to take part in the study).

Does the program map to the curriculum?

Yes. The program has been to the following:

- ✓ Welsh National Curriculum
- ✓ Social and Emotional Aspects of Learning Cymru
- ✓ Welsh Network of Healthy School Schemes

For more information please refer to the Curriculum Mapping Information Sheet.

How will my school benefit from taking part?
The derived program is based on interactive and explorative learning techniques. Pupils will have the chance to receive a unique and novel curriculum which will help them explore and question their beliefs on risk and home safety in relation to burn prevention. They will be taught a safe approach to handling hot food /drinks and other household burn hazards. The program will teach them invaluable first aid knowledge and skills in a safe and known environment. Pupils who take part in the study will be awarded with certificates, a sticker and a small gift (a fridge magnet detailing burns first aid treatment) at completion.

The 'Learn About Burns' program is also recognised by the Cardiff Healthy Schools Network and can be used as evidence towards the Healthy Schools Topic Area of 'Safety' *[for more information on this please see refer to the Curriculum Mapping Information Sheet].*

Upon completion and analysis of the program the researcher will offer to visit the school to provide an overview of results for staff and pupils.

Is there a cost?
No. The study entails no costs to the school. The study is organised and run by The Burns Collective based in Cardiff University, School of Medicine. All resources and materials will be provided by the researcher/research team funded by The Healing Foundation.

What is the next step if I would like to take part or find out more information?
If you think your school might be interested in taking part in the study or would like some more information please contact Harriet Quinn-Scoggins by telephone on 029 2068 7945 or via email at Quinn-ScogginsHD@Cardiff.ac.uk. A school visit can be arranged to discuss the next steps and moving forward.

Appendix 45 – Learn About Burns feasibility study headteacher consent form

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

CARDIFF UNIVERSITY
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Headteacher Consent Form- Learn About Burns

Please take your time to read the consent form below. If you have any questions or comments please feel free to discuss these with the researcher.

Please initial each box and sign and date the bottom of this form if you are willing to consent your school to the research study

I understand that [insert name of school] participation in this project will involve: ☐

- provision of a maximum of three hours to the study per class (approximately 40 minutes on three separate occasions). The first two sessions need to be on consecutive weeks. The third session will be three months later
- provision of a staff member to remain with the researcher in the classroom for the duration of all three sessions
- to distribute 'Parent Opt-Out Letters' and 'Pupil Information Sheets' four weeks before the first session
- to inform the research team of any 'opt-out' slips that are returned to the teacher and provide alternative provision for those students who will not take part in the study
- one short interview with staff involved with the study

I understand that [insert name of school] participation in this study is entirely voluntary..... ☐

I understand that pupils involved within the study are free to withdraw at any time and without giving a reason..... ☐

I understand that all student personal information will be handled confidentially and stored securely once collected..... ☐

I understand that all student responses will be stored anonymously and securely once collected..... ☐

I understand that all information appearing in the final thesis and any subsequent academic papers will be anonymous..... ☐

I understand that I am free to ask any questions, or discuss any comments, at any time with Harriet Quinn-Scoggins or another member of the research team..... ☐

I understand that at the end of the study I will be offered a de-brief and feedback on the results of the study..... ☐

Headteachers Signature: _____ **Date:** _____

Researchers Signature: _____ **Date:** _____

Appendix 46 – Learn About Burns feasibility study knowledge, attitude, self-efficacy and practice questions across all three time-points

Learn About Burns Study

Knowledge, Attitude, Self-Efficacy and Practice Questions

*[Knowledge, Attitude and Self-Efficacy Questions will stay the same throughout all data collection time-points (question order by topic will be modified). Practice questions will alter depending on the time-point]. Where appropriate the correct answer is denoted by ** and bold text.*

Knowledge

Prevention

1. If something is hot and too heavy for me to lift I should
    a. **Wait and ask an adult to help** **
    b. Try anyway
    c. Ask a younger brother or sister to help
    d. I don't know
2. If I am going to touch something hot I should
    a. Touch it with the tips of my fingers to see if it is hot first
    b. **Use something to protect my hands** **
    c. Pick it up with my hands straight away
    d. I don't know
3. When making a cup of tea I should
    a. **Get everything I need out of the cupboards first** **
    b. Get everything I need after I have turned the kettle on
    c. It doesn't matter which order I do things
    d. I don't know
4. When filling the kettle I should
    a. Fill the kettle all the way to the top
    b. **Only use the amount of water I need** **
    c. Fill the kettle half way
    d. I don't know
5. When pouring hot liquid I should
    a. **Pour slowly and carefully away from me avoiding the steam** **
    b. Pour it very quickly
    c. Pour slowly and carefully with the steam coming towards me
    d. I don't know
6. When filling a hot water bottle I should
    a. Have the hot water bottle lying down on the kitchen side
    b. **Have the hot water bottle lying down in the sink** **
    c. Hold the hot water bottle upright in front of me
    d. I don't know
7. How long does a cup of tea take to cool down?
    a. 10 minutes
    b. 20 minutes
    c. **30 minutes** **
    d. I don't know
8. How liquids and appliances should be placed
    a. **On a flat steady surface away from the floor** **

b. On the floor
c. On a wobbly surface away from the floor
d. I don't know

First Aid

1. What should be used to cool a burn?
    a. **Cold running water** **
    b. Ice
    c. A wet flannel
    d. I don't know
2. How long should you cool a burn?
    a. 5 minutes
    b. 10 minutes
    c. **20 minutes** **
    d. I don't know
3. What should be used to cover a burn?
    a. A plaster
    b. **Clingfilm** **
    c. A damp flannel
    d. I don't know
4. When should I tell an adult?
    a. **Straight away** **
    b. Wait until you have finished cooling the burn
    c. Wait until you have covered the burn
    d. I don't know
5. Should I put any creams on top of a burn?
    a. Before it has been cooled
    b. After it has been cooled
    c. **Never** **
    d. I don't know
6. Should clothing and jewellery be removed from close to the burn?
    a. **Yes** **
    b. No
    c. I don't know

Attitude

[5-point Likert Scale – awful/not very good/good/really good/brilliant with a pictorial of a changing smiley face]

1. Giving first aid is a good thing to do
2. Giving first aid is unpleasant
3. Give first aid is important
4. Giving first aid can make a difference
5. Anyone can learn first aid

Self-Efficacy

[10-point Self-Efficacy Scale 0-10]

1. I can help someone if they have a burn injury
2. I can call for help if someone has a burn injury
3. I can perform first aid if someone has a burn injury
4. I can keep myself safe whilst helping someone with a burn injury
5. I can manage some type of first aid

Practice

[Binary Yes/No Questions]

T1(Pre-intervention delivery)

1. Have you ever had a burn?
2. Have any of your family or friends ever had a burn?
3. Thinking about any burn, did they have any first-aid?
4. Did they use cold running water for at least 20 minutes?
5. Did they use a damp cloth?
6. Did they use ice?
7. Did they use cling film to cover their burn?
8. Did they use a plaster to cover their burn?
9. Did they go to the doctors for help?
10. Did they go to the hospital for help?
11. Have you ever been taught how to make a hot drink safely?
12. Have you ever been taught how to use the oven safely?
13. Have you ever been taught any first-aid before?
14. Have you ever been taught any burns first-aid before?

T2 (Post-intervention delivery)

1. In the last two weeks you had a burn?
2. In the last two weeks have any of your family or friends had a burn injury?
3. Did they have any first-aid for their burn injury?
4. Did they have the correct burns first aid?
5. Did you help?
6. Did they use cold running water for at least 20 minutes?
7. Did they use cling film to cover their burn?
8. Did they go to the doctors for help?
9. Did they go to the hospital for help?
10. Did you talk to any family or friends about what we talked about last week?
11. Have you changed the way you act in the kitchen, whilst making any hot foods or drinks?

T3 (Six months post intervention delivery retention)

1. In the last six months have you had a burn injury?
2. In the last six months have any of your family or friends had a burn injury?
3. Did they have any first-aid for their burn injury?
4. Did they use the correct burns first-aid?
5. Did you help?
6. Did they use cold running water for at least 20 minutes?
7. Did they use cling film to cover their burn?
8. Did they go to the doctors for help?
9. Did they go to the hospital for help?
10. In the last six months have you made a hot drink at home on your own?
11. In the last six months have you been taught first-aid anywhere else?
12. Did you talk to any family or friends about what we learnt?
13. Did you put your first-aid magnet on the fridge?
14. Have changed the way you act in the kitchen, whilst making any hot foods or drinks?

Appendix 47 – Learn About Burns feasibility study student information sheet

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

CARDIFF UNIVERSITY
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The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Pupil Information Sheet – Learn About Burns

Researchers at Cardiff University are doing a research project and would like to ask you for your help. Research means finding out more about something. It is a way we try to find out the answers to important questions.

What is the study called?
The study is called 'Learn About Burns'.

Why is it being done?
Some children have accidents called burns. Unfortunately burns can be very painful and cause damage to your skin that can mark your skin for life. We would like to teach children how to be safe, and to try and stop accidents from happening. To do this we have to check that what we are teaching really helps. We would like you to help us find out!

Why have I been chosen to take part?
We have invited schools in Cardiff to take part, and your school has agreed to help. We are now asking you to take part too.

What do I have to do to take part?
Nothing. A researcher will come to your school to teach you for two lessons, and will give you a short quiz. During the lessons you will get to take part in lots of fun and exciting activities learning about home safety and first aid! The researchers will know what you have answered to the questions – but no one else.

Will joining in help me?
We hope that from the special lessons you will avoid having a burn yourself, and will know how to help someone who has a burn. You will be the first students to try out this special program, and we will give you some cool stickers and stuff to remember what you learnt!

Do I have to take part?
No, you don't have to take part. You can say that you would not like to and no one will be cross or upset. If you say yes, but later change your mind that is alright as well. If you don't want to take part in the study you must tell your parents or your school teacher.

Did anyone else check that the study was ok to do?
Before any research is allowed to happen, it has to be checked by a group of people called a Research Ethics Committee. They make sure that the research is fair. The 'Learn About Burns' Study has been checked by the Cardiff University School of Medicine Research Ethics Committee.

What do I do now?
Take time to decide whether or not you would like to take part, and please ask us if there is anything that you do not understand. If you have questions that for us, you can email us on Quinn-ScogginsHD@Cardiff.ac.uk and we will try and answer your question as quickly as possible.

Appendix 48 – Learn About Burns feasibility study parent opt-out form

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

CARDIFF UNIVERSITY
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The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Dear Parent/Guardian,

We would like to invite your child to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve. Please take time to read through the information provided, and contact us to discuss any questions you may have, or if anything has not been made clear.

What is the study title?
Learn About Burns

Who is organising the study?
The study is organised by Cardiff University. The program has been devised by a team of researchers who are part of the Children's Burns Research Centre, sponsored by The Healing Foundation.

Who will be conducting the study?
Harriet Quinn-Scoggins, a PhD researcher at Cardiff University's School of Medicine.

What is the purpose of the study?
We wish to evaluate a newly developed school program called 'Learn About Burns'. 'Learn About Burns' will teach children about how to prevent burn injuries, and burns first aid if an accident does occur. The program will include one lesson about burn prevention, and one on burns first aid, as well as a little quiz to check that they have learnt the messages.

Will my child lose out on any teaching time?
No, the study will be integrated into your child's classes. The program has been mapped to English, Mathematics, Science and Personal and Social Education within the Welsh National Curriculum.

Why has my child been invited?
As part of this research we are asking all Year-4 students in your child's school to take part in the program. Your child will be asked to answer some questions to find out how much the program has taught them about burns prevention and first aid, how confident they would feel in administering first aid if they needed to, and overall, whether they enjoyed the program.

What will the children have to do?
The program and questions will be completed during school hours. Your child will only take part in the program if she or he agrees. Your child will also receive information about the program, and be able to ask questions before they make their decision. Taking part is entirely voluntary.

Who will be collecting the data?
All data will be collected by Harriet Quinn-Scoggins.

Can I withdraw my child from the study?
Your child can choose to withdraw from the study at any time. To do so you must return this slip before Friday 17th June or contact the class teacher or the research team directly. The research team can be contacted via email at Quinn-ScogginsHD@Cardiff.ac.uk or via phone on 029 2068 7945.

Will the data you collect be confidential?
Any data collected will be completely confidential, your child's name or personal details will not be recorded anywhere, or kept by the researcher. What your child tells us will be used to try and improve the program and young people's health and safety. We will follow ethical and legal practice for the protection of your child's data. No-one except the research team will find out what they say. All data will be stored anonymously and held in a secure location that can only be accessed by authorised members of the research team. When we write reports based on the research, your child will not be named or in any way be identified.

Ethical Approval
Before any research goes ahead it has to be checked by a Research Ethics Committee. They make sure that the research is fair. This project has been checked by the Cardiff University School of Medicine Research Ethics Committee.

We hope you are happy for your children to participate. If you are, you do **NOT** need to do anything.

Below is an opt-out of slip for this study. If you would not like your child to take part in this study please fill-in the slip at the bottom of this letter and return it to the class teacher. If you do not return this slip it will be assumed that you are happy for your child to take part in this study.

Kind regards,

Harriet Quinn-Scoggins

Learn About Burns

I understand that Harriet Quinn-Scoggins will be conducting the above study at my child's school.

I **do not** wish my son/daughter to be included in this study.

Name of child: _____

Class: _____

Signed: _____ (Parent/Guardian)

Date: _____

Please return this form to your class teacher as soon as possible if you do not wish your son or daughter to take part in the study

Appendix 49 – Learn About Burns feasibility study semi-structured interview guide for teachers

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Semi-Structured Interview Guide

Introduction

- Introduce yourself [researcher] and the purpose of the interview
- Reaffirm that the interviewee is happy for the interview to be audio-recorded and for anonymised quotes to be used in subsequent reports or publications
- Reaffirm that the interviewee is happy with the consent process [to be completed before the interview]

Questions	Prompts & Probes
Acceptability	
1. What did you think about the program? a. Were you happy with how the program was delivered? 2. What did you expect from the program? a. Did the program meet your expectations? b. How? Why? 3. Would you be happy for someone to deliver the program again? a. How? Why? When? 4. What did you think about the program content? a. Was it appropriate for the age group? 5. What did you think about the materials and resources? a. Were they appropriate for the age group? 6. Do you think the program was appropriate to be delivered in the school? Classroom? a. Why? / Why not? 7. Did you receive any comments about the program from parents? a. Were they generally positive or negative? 8. Overall do you think that parents were happy with the contents of the program? 9. Is there anything in particular that you would change about the program? a. How? Why?	➢ Tell me more about that ➢ In what way? ➢ What do you mean by that? ➢ Timing/ duration of program? ➢ Materials / activities used? ➢ Can you give me an example? ➢ What would that look like? ➢ Can you tell me more about that please? ➢ How did others respond to that? ➢ Why was that important to you? ➢ Why does that matter to you? ➢ How do you feel about that? ➢ What was significant about this to you?

Demand and Integration	
1. How do you think the program fitted in with the curriculum? 2. Did the program fit well with the overall ethos and working format of the school? 3. Would you be happy to deliver the program yourself if the materials and resources were made available to you? a. Why? / Why not? 4. Do you think the school would actively run the program again if it was available? a. Why / Why not? 5. How do you think the first and second sessions ran?	➢ Tell me more about that ➢ In what way? ➢ What do you mean by that? ➢ Can you give me an example? ➢ What would that look like? ➢ Can you tell me more about that please? ➢ How did others respond to that? ➢ Why was that important to you? ➢ Why does that matter to you? ➢ How do you feel about that? ➢ What was significant about this to you?
Practicality and Implementation	
1. Was there any part of the program that made it particularly easy or hard for you or the school to run or take part in? 2. What do you think about the length of the program? 3. What do you think about the quality of the intervention? 4. To your knowledge were all the pupils able to carry out the intervention activities? 5. Do you think the pupils were engaged with the program? a. How? Why? 6. Were there any parts of the program which the pupils engaged with more or less? a. How? Why? 7. Do you think the pupils enjoyed the program? a. How? Why? 8. Were there any parts of the program which the pupils enjoyed more or less? a. How? Why?	➢ Tell me more about that ➢ In what way? ➢ What do you mean by that? ➢ Can you give me an example? ➢ What would that look like? ➢ Can you tell me more about that please? ➢ How did others respond to that? ➢ Why was that important to you? ➢ Why does that matter to you? ➢ How do you feel about that? ➢ What was significant about this to you?

Conclusion

- Thank the interviewee for their time
- Explain that if they have any questions, comments or concerns regarding the interview that they can contact you by phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk

Appendix 50 – Learn About Burns feasibility study parent interview information sheet

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

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The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Dear Parent/Guardian,

Recently your child has taken part in the 'Learn About Burns' program during school. Following this program we would like to invite you to take part in a telephone interview to find out what your views on the program and broader beliefs about health promotion within schools. Before you decide we would like you to understand why this part of the research is being done and what it would involve. Please take time to read through the information provided, and contact us to discuss any questions you may have, or if anything has not been made clear.

What is the study title?
Learn About Burns

Who is organising the study?
The study is organised by Cardiff University. The telephone interviews have been devised by a team of researchers who are part of the Children's Burns Research Centre, sponsored by The Healing Foundation.

Who will be conducting the interview?
Harriet Quinn-Scoggins, a PhD researcher at Cardiff University's School of Medicine.

What is the purpose of the interview?
We wish to evaluate a newly developed school program called 'Learn About Burns'. The 'Learn About Burns' program teaches children about how to prevent burn injuries, and how to administer correct burns first aid if an accident does occur. Your child has recently received this program at their school. We would like to gain feedback from parents/carers about the program. Questions will be based on whether you believe that such a program is needed, whether your child spoke to about what they learnt at home, whether you had noticed any changes in your child's practices or behaviours since receiving the program and your opinions on school-based health promotion activities and the importance of injury prevention in society.

Why have I been invited?
As part of this research we are asking all parents/carers of Year-4 students who took part in the program to take part in a telephone interview.

What will I have to do?
Nothing. Following reading this information sheet, if you are interested in taking part in an interview please fill in the slip below and return it to your child's class teacher. Taking part is entirely voluntary.

When will the interview take place?
If you return the below slip the researcher will contact you to organise a time for the interview that is convenient for you. The interview will last no longer than 20 minutes.

Will I be compensated for my time?
A £10 love to shop voucher will be provided directly to any parents/carers who complete the interview.

Who will be collecting the data?
All data will be collected by Harriet Quinn-Scoggins. The interview will be audio-recorded for later analysis.

Will the data you collect be confidential?
Any data collected will be completely confidential, your name or personal details will not be recorded anywhere, or kept by the researcher. What you tell us will be used to try and improve the program and young people's health and safety. We will follow ethical and legal practice for the protection of your data. No-one except the research team will find out what you say. All data will be stored anonymously and held in a secure location that can only be accessed by authorised members of the research team. When we write reports based on the research, you will not be named or in any way be identified.

Ethical Approval
Before any research goes ahead it has to be checked by a Research Ethics Committee. They make sure that the research is fair. This project has been checked by the Cardiff University School of Medicine Research Ethics Committee.

I have some more questions, who can I contact?
If you have any further questions or comments do not hesitate in contacting Harriet Quinn-Scoggins via phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk.

We hope you are interested in taking part in a telephone interview. If you are, please return the following slip to your child's teacher by [insert date].

Kind regards,
Harriet Quinn-Scoggins

Learn About Burns

I have read the above information and would like to be contacted by Harriet Quinn-Scoggins with regards to setting up a telephone interview.

My child's name: _____

My name: _____

My Signature: _____

Date: _____

My contact telephone number: _____

My email address: _____

I would rather be contacted by [please delete one] telephone / email to organise a convenient interview time

Please return this form to the class teacher as soon as possible if you wish to take part in a telephone interview

Appendix 51 – Learn About Burns feasibility study oral consent script for teachers and parents

Division of Population Medicine
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Telephone Interview Oral Consent Script

The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Please explain the consent process to participants. Please read the following word-for-word to each participant before the start of questions. Please ask participants to responded with a 'yes' to each point if they agree. After completion of the interview please email this document to all participants.

- I received and have read the parent interview information sheet
- Any questions, queries or comments I had have been answered by Harriet Quinn-Scoggins or another member of the research team
- I understand that my participation in this interview is entirely voluntary
- I understand that I am free to withdraw at any time and without providing a reason
- I understand that the telephone interview will be audio-recorded for later analysis
- I understand that all data and responses will be handled confidentially, stored securely and anonymised once collected
- I understand that all information and direct quotations appearing in research outputs will be anonymous and handled sensitively
- I understand that I am free to ask any questions, or discuss any comments, at any time with Harriet Quinn-Scoggins or another member of the research team
- I understand that upon interview completion I will receive a [insert appropriate price here] Love to Shop voucher to thank me for my time

Appendix 52 – Learn About Burns feasibility study semi-structured interview guide for parents

Division of Population Medicine
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The Burns Collective
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A Healing Foundation Initiative

Parent Telephone Semi-Structured Interview Guide
15 - 20 minutes

Introduction

- Introduce yourself [researcher] and the purpose of the interview
- Complete consent – refer to telephone interview consent script

Questions	Prompts & Probes
• Were you aware that your child has recently received the 'Learn About burns' program in school? • Were you happy for your child to take part in the study? • Were you happy for you're the program to take place during school time? – specifically PSHE lessons? • Do you think there is a need for a burns prevention program? • Did your child talk to you, or anyone else at home or outside school, about what they had learnt? • Have you seen, or are you aware of, your child's certificate, sticker or first-aid fridge magnet? • Do you think it is good for children to learn about health promotion in school? • Do you think it is important for children to learn about safety and injury prevention?	➢ How? ➢ Why? ➢ Tell me more about that ➢ In what way? ➢ What do you mean by that? ➢ Timing/ duration of program? ➢ Materials / activities used? ➢ Can you give me an example? ➢ What would that look like? ➢ Can you tell me more about that please? ➢ How did others respond to that? ➢ Why was that important to you? ➢ Why does that matter to you? ➢ How do you feel about that? ➢ What was significant about this to you?

Conclusion

- Thank the interviewee for their time
- Check information on the deliverance of their 'Love to Shop' voucher
- Explain that if they have any questions, comments or concerns that they can contact you by phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk

Appendix 53 – Learn About Burns feasibility study student information sheet for focus groups

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

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The Burns Collective
Leading Children's Burns Research
A Healing Foundation Initiative

Pupil Information Sheet – Learn About Burns Focus Group

Researchers at Cardiff University are doing a research project and would like to ask you for your help. Research means finding out more about something. It is a way we try to find out the answers to important questions.

What is the study called?
The study is called 'Learn About Burns'.

Why is it being done?
Recently you took part in a program called 'Learn About Burns' at school. We would like to invite you to talk to us about the program. We are interested in finding out whether you like it, if you thought it was important and whether you would change anything for other children doing it in the future.

Why have I been chosen to take part?
All students who have taken part in the program in your school have been invited to tell us what they think.

What do I have to do to take part?
Nothing. A researcher will talk to a group of students during lunchtime at your school. The researcher will ask you questions to help them understand what children liked and did not like about the program and why. The researchers will know what you have answered to the questions – but no one else.

Do I have to take part?
No, you don't have to take part. You can say that you would not like to and no one will be cross or upset. If you say yes, but later change your mind that is alright as well. If you don't want to take part in the study you must tell your parents or your school teacher.

Did anyone else check that the study was ok to do?
Before any research is allowed to happen, it has to be checked by a group of people called a Research Ethics Committee. They make sure that the research is fair. The 'Learn About Burns' Study has been checked by the Cardiff University School of Medicine Research Ethics Committee.

What do I do now?
Take time to decide whether or not you would like to take part, and please ask us if there is anything that you do not understand. If you have questions that for us, you can email us on Quinn-ScogginsHD@Cardiff.ac.uk and we will try and answer your question as quickly as possible.

Appendix 54 – Learn About Burns feasibility study parent consent form for student focus groups

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

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The Burns Collective
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A Healing Foundation Initiative

Dear Parent/Guardian,

Recently your child has taken part in the 'Learn About Burns' program during school. Following this program we would like to invite your child to take part in a focus group to find out what your child thought about the program and whether they enjoyed it. Before you decide we would like you to understand why this part of the research is being done and what it would involve. Please take time to read through the information provided, and contact us to discuss any questions you may have, or if anything has not been made clear.

What is the study title?
Learn About Burns

Who is organising the study?
The study is organised by Cardiff University. The focus group has been devised by a team of researchers who are part of the Children's Burns Research Centre, sponsored by The Healing Foundation.

Who will be conducting the focus group?
Harriet Quinn-Scoggins, a PhD researcher at Cardiff University's School of Medicine.

What is the purpose of the focus group?
We wish to evaluate a newly developed school program called 'Learn About Burns'. The 'Learn About Burns' program teaches children about how to prevent burn injuries, and how to administer correct burns first aid if an accident does occur. Your child has recently received this program at their school. We would like to gain feedback from the children about the program. Questions will be based on what they enjoyed, what they did not enjoy, whether they felt that learnt something new and how they think it could be improved for more children in the future.

Will my child lose out on any teaching time?
No, the focus group will be integrated into your child's lunchtime.

Why has my child been invited?
As part of this research we are asking all Year-4 students in your child's school who took part in the program to join us for the focus group. Due to the nature of focus groups we have to limit spaces to 8 children on a first-come-first-serve basis.

What will the children have to do?
Nothing. Following eating their lunch the children will be asked to meet as a group and discuss their ideas with the researcher. Your child will only take part in the focus group if she or he agrees. Your child will also receive information about the focus group, and be able to ask questions before they make their decision. Taking part is entirely voluntary.

Who will be collecting the data?
All data will be collected by Harriet Quinn-Scoggins. All discussions and responses during the focus group will be audio-recorded.

Will the data you collect be confidential?
Any data collected will be completely confidential, your child's name or personal details will not be recorded anywhere, or kept by the researcher. What your child tells us will be used to try and improve the program and young people's health and safety. We will follow ethical and legal practice for the protection of your child's data. No-one except the research team will find out what they say. All data will be stored anonymously and held in a secure location that can only be accessed by authorised members of the research team. When we write reports based on the research, your child will not be named or in any way be identified.

Ethical Approval
Before any research goes ahead it has to be checked by a Research Ethics Committee. They make sure that the research is fair. This project has been checked by the Cardiff University School of Medicine Research Ethics Committee.

I have some more questions, who can I contact?
If you have any further questions or comments do not hesitate in contacting Harriet Quinn-Scoggins via phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk.

We hope you are happy for your children to participate. If you are, please return the following slip to your child's teacher by [insert date].

Kind regards,
Harriet Quinn-Scoggins

Learn About Burns

Statement of consent:

I have read the above information, and have received answers to any questions I have asked.
By signing below, I give permission for my child to participate in the focus group and understand that the focus group will be audio-recorded.

Name of child: _____

Class: _____

Signature: _____ (Parent/Guardian)

Printed Name: _____ (Parent/Guardian)

Date: _____

Please return this form to the class teacher as soon as possible if you wish your son or daughter to take part in the focus group

Appendix 55 – Learn About Burns feasibility study student focus group topic guide

Division of Population Medicine
Yr Isadran Meddygaeth Boblogaeth

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The Burns Collective
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A Healing Foundation Initiative

Student Focus Group Guide
20 – 30 minutes

Introduction

- Introduce yourself [researcher] and the purpose of the interview and ask if students have any questions
- Ask students to complete assent forms, explain that focus group will be audio-recorded and for anonymised quotes to be used in subsequent reports or publications

Activity One – Group Discussion

- The group will be asked to discuss the following points in a question and answer format with inter-group and peer led discussion supported on the following topics
  - Can you remember the program?
  - What parts can you remember?
  - Why do you think you can remember those parts?
  - Did you enjoy the program?
  - What parts can you remember?
  - Why do you think you enjoyed those parts?
  - What did you not enjoy?
  - Do you think other children would enjoy the program?

Activity Two – Energise Ranking Activity

- Several coloured pieces of paper will be placed around the room. Each colour will correspond to an answer in each question. Children will be asked to run to, and stand by their chosen answer in a ranking format. From their most favourite to their least favourite. The researcher will select students to feedback responses on why they chose that answer for each question and level. Ranking exercises will be based on:
  - Which lesson the students enjoyed the most
  - Which lesson the students thought was the most important
  - Which activity the students enjoyed the most
  - Which activity the students enjoyed the least
  - How the children think they learn things best
  - Which lesson they think is the most useful

Activity Three – Draw and Write Activity

- Students will be supplied with a piece of paper, pens and pencils. The piece of paper will be blank on the top for drawing and have lines on the bottom for writing. Students will be asked to think about the question 'If I could help make this program better for other children I would…' and either draw, write or draw and write their responses. Guidance will be provided for this exercise to make sure that students stay on track and 'realistic' with their responses.

Conclusion

- Thank the students for their time
- Explain that if they have any questions, comments or concerns then can contact you by phone on 029 2068 7945 or by email at Quinn-ScogginsHD@Cardiff.ac.uk

Appendix 56 – Learn About Burns feasibility study description of student focus group activities

Introduction

The researcher and research assistant introduced themselves to the group and explained the purpose of the focus group and its format. Although parental consent was previously obtained, students were asked to provide individual written assent for taking part [Appendix 15]. The digital audio-recording device was turned on and each child was asked to introduce themselves by name to increase ease of transcription.

Activity One

The first activity was a discussion on the content of the intervention. This activity hoped to help the students think reflectively about the intervention and engage them in remembering the content and format of the lessons through a series of open-ended questions. Each child was equally encouraged to provide a response to each question and welcomed to do so, though not pressured if they showed any signs that they were not happy to. Following individual responses children were asked to discuss their answers and any comments or responses that they had about other's answers in a friendly and supportive way.

Activity Two

The second activity was a ranking exercise conducted as an energise activity with numbers placed on the walls around the room. Numbers corresponded with multiple choice answers to ascertain their least and most favourite parts of the intervention; these were depicted pictographically with one picture per activity [Appendix 19]. Students were asked to explain their choices and open discussion was encouraged.

Activity Three

The third activity involved a draw and write exercise exploring what pupils would change or include in the lessons if they had the chance. Students were provided with a sheet of paper that had blank space at the top, and a series of lines at the bottom [Appendix 20]. It was explained to pupils that they could draw and/or write whatever they liked around the

question ‘What would you change, or add, to the Learn About Burns Program to make it better for other children in the future?’. To encourage free-thought and creativity little further guidance was offered; only direct questions were answered by either researchers.

Appendix 57 – Learn About Burns feasibility study student assent form for student focus groups

Division of Population Medicine
Is-adran Meddygaeth y Boblogaeth

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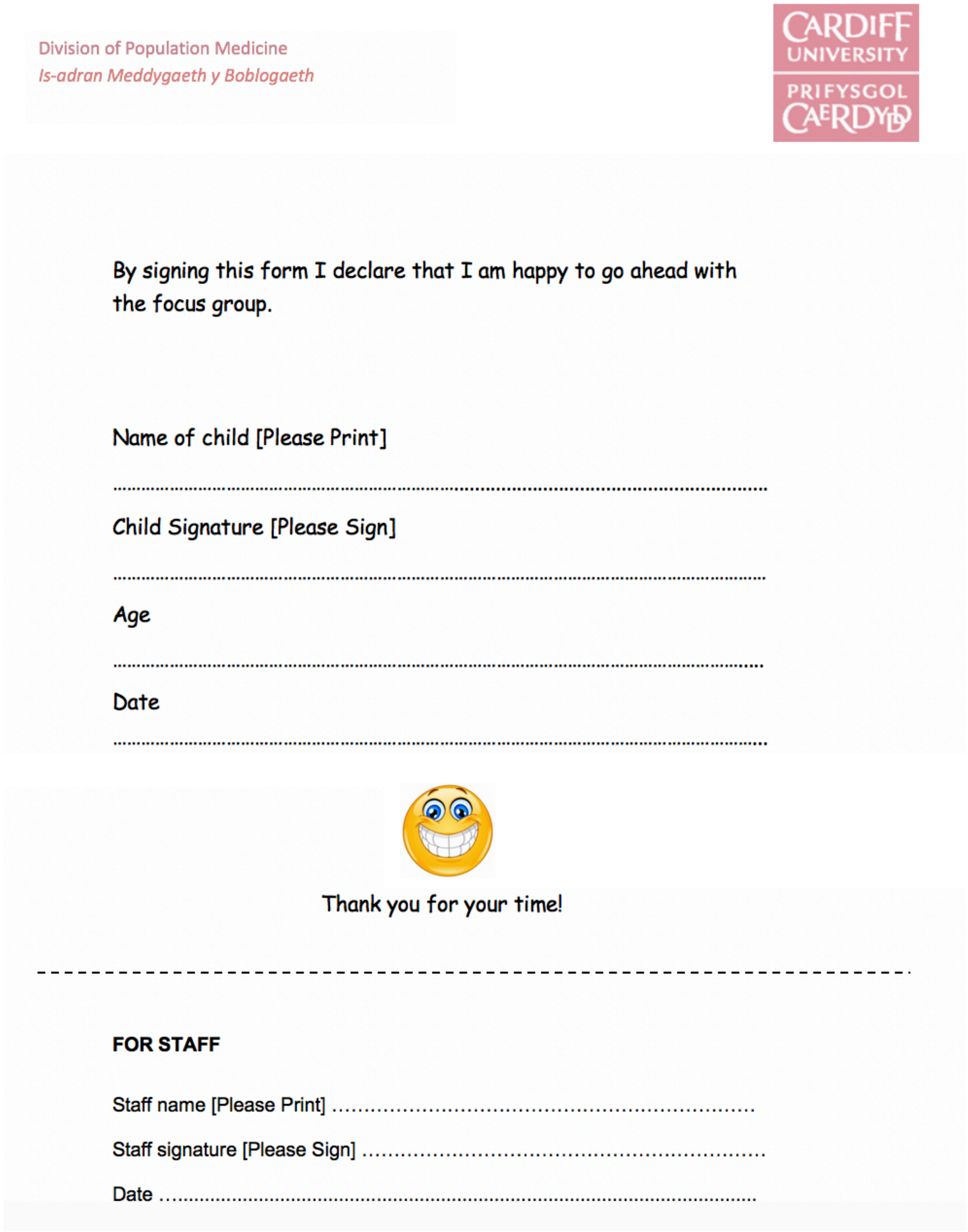
A Healing Foundation Initiative

Child Assent Form – Student focus Group

Please read the points below. If you are happy with each point please circle the 'thumbs up' picture next to it and sign below. If you are confused or have any questions please ask.

By signing this form I understand that:|

- I will be taking part in a focus group that will ask me my opinions on the 'Learn About burns' program
- I do not have to answer any questions if I do not want to
- My voice will be audio-recorded
- I understand that any answers I give, drawings or writings I make may be used for written pieces of work or presentations about the research
- I understand that if any answers I give, drawings or writings I make are used, that no one will know they are from me
- I understand that taking part is completely up to me – it is my decision
- I can change my mind about taking part at any time



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Is-adran Meddygaeth y Boblogaeth

By signing this form I declare that I am happy to go ahead with the focus group.

Name of child [Please Print]

....

Child Signature [Please Sign]

....

Age

....

Date

....

Thank you for your time!

- -

FOR STAFF

Staff name [Please Print] ....

Staff signature [Please Sign] ....

Date ....

Appendix 58 – Learn About Burns feasibility study student focus group draw and write exercise sheet

How do you think we can improve "Learn About Burns" for more children in the future?

Draw about it here...

Write about it here...

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Appendix 59 – Learn About Burns feasibility study detailed description of qualitative analysis process

Step 1 – Transcription

Verbatim transcription of all recorded data was conducted externally by a professional transcriber. Upon completion transcripts were checked for consistency and accuracy alongside original recordings with minor mistakes and/or in-audibles corrected. Transcripts were uploaded to NVivo 11 Qualitative Data Analysis Software (QSR International PTY LTD 2015).

Step 2 – Familiarisation

Familiarisation with, and immersion in, the data was conducted by the researcher by listening to complete audio files and re-reading complete transcripts alongside any contextual and reflective notes that were recorded. Printed transcripts were used at this stage to enable analytical notes, thoughts and impressions to be recorded in the margins.

Step 3 – Coding

Fifty percent of transcripts were individually assessed line by line with deductive and inductive codes applied where appropriate in NVivo by two qualitative researchers. Notes and thoughts on categories, anomalies, themes and interpretations were recorded in analytic memos iteratively.

Step 4 – Developing an Analytical Framework

An analytical framework was developed from the agreed codes, categories and themes identified and discussed by both researchers and definitions set. The development of the analytical framework was an iterative process with changes being made and versions altered throughout the analysis and interpretation process. The final analytical framework is attached as Appendix…

Step 5 – Applying the Analytical Framework

The analytical framework was applied to all transcripts consistently with the defined codes, categories and themes.

Step 6 – Charting Data into the Framework Matrix

A spreadsheet was used to generate a matrix to chart the data. Codes, categories and themes were placed along the horizontal axis, and participants along the vertical axis. Data for each code were summarized by participant and charted onto the matrix alongside illustrative quotations.

Step 7 – Interpreting the data

A notebook was used to record impressions, ideas and interpretations at all stages. Following matrixing, characteristics, differences and similarities of the data were mapped to explore connections within and between participants and categories. This process was influenced by the a-priori codes and the inductive exploration with open coding. Ideas were generated and explored that reached beyond a description and towards themes that offered explanations for what was happening within the data.

Appendix 60 – Learn About Burns feasibility study qualitative analysis coding framework

Theme	Sub-Theme	Definition
Feasibility and Acceptability of the Intervention	**Content and Materials**	Any discussion or points made regarding whether the content was deemed to be of a suitable level for students regarding age, intellectual ability, tailoring and relevance. Any discussion or points made regarding the delivery of the program materials (including presentations, videos, certificates and fridge magnets), the concept of the 21st Century classroom and interactivity.
	Format and Delivery	Any discussion or points made regarding the format and/or structure of the program including those relating specifically to the context of the school or classroom. Any discussion or points made regarding the delivery of the program.
	Integration	Any discussion or points made regarding the integration of the program with the current school or class workings, the school ethos, curriculum or teaching topics.
	Reach and Impact	Any discussion or points made regarding the reach of the program in relation to student, teacher or parent led discussions, actions or behaviours outside of active program delivery to others. Any discussion or points made regarding the impact of the program in relation to student, teacher or parent led discussions, opinions,

		views, actions or behaviours outside of active program delivery.
	Perceived Benefits	Any discussion or points made regarding the prior or post perceived benefits of the program, or the act of taking part in the program.
	Empowering Children	Any discussion or points made regarding the program empowering children to increase their independence in their home or family life or through their own learning.
	Engagement and Enjoyment	Any discussion or points made regarding the engagement and/or enjoyment of the students and/or teacher during active program delivery as a whole or by activity.
	Suggestions for Improvement	Any discussion or points made regarding suggestions for improvements of the program.
Feasibility and Acceptability of the Research Study Methods	**Consent Procedures**	Any discussion or points made regarding the research study consent procedures at the school level or regarding using the parent opt-out approach.
	Data Collection Techniques	Any discussion or points made regarding the use of clickers as a data gathering tool.
Emergent Themes	**Co-learning**	Any discussion or points made regarding two or more people together.
	Health Promotion, First-Aid and the School Curriculum	Any discussion or points made regarding health promotion and first-aid within the school, relating to both curricula and non-curricula activities; whether it is appropriate to be taught in schools; and how much time is allocated to either.

	Childhood Home Experiences	Any discussion or points made regarding the sharing of family or cultural information during or after the program (though facilitated by it). Any discussion or points made regarding the sharing of personal or narrative home experiences and activities relating to program content during or after the program (though facilitated by it).
	Burn Experiences and Childhood Risk Perception	Any discussion or points made regarding the sharing of personal or family burn experiences. Any discussion or points made regarding childhood risk perceptions (in general, and those relating directly to burns) and views on childhood actions as a consequence of these views.
	Public Knowledge and Awareness of Burn Injuries and Burns First-Aid	Any discussion or points made regarding personal and public knowledge and awareness of burn injuries (including frequency, severity and risk factors) and personal and public knowledge of burns first-aid.

Appendix 61 – Learn About Burns feasibility study ethical approval letter from Cardiff University, School of Medicine Research Ethics Committee

School of Medicine
Dean Professor John Bligh BSc MBChB MA(Lit) MMEd MD FRCGP HonFAcadMEd
Ysgol Meddygaeth
Deon Yr Athro John Bligh BSc MBChB MA(Lit) MMEd MD FRCGP HonFAcadMEd

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Parc Mynydd Bychan
Caerdydd CF14 4XN

Friday 26th February 2016

Harriet Quinn-Scoggins, Alison Kemp
Division of Population Medicine
3rd Floor, Neuadd Meirionnydd
School of Medicine
Heath Park

Dear Harriet,

Re: A School based programme for preventing childhood burns

SMREC Reference Number: 16/15

This application was reviewed by the Committee on Wednesday 17th February 2016.

Ethical Opinion

On review, the Committee have asked for the following issue to be addressed:

1. Remove the statement in the Headteacher Consent Form and Interview Consent Form that states 'I understand I am free to contact the Cardiff University School of Medicine Ethics Committee to discuss any questions of concerns I may have'.

Please send the revised Consent Forms to the Committee Secretary, Miss Claire Batten.

Documents Considered

Document Type:	Version:	Date Considered:
Application	Signed 04/02/2016	17/02/2016
Email from A Kemp	05/02/2016	17/02/2016
Supporting Document	V1.1 04/02/ 2016	17/02/2016
Lesson Plan 1	V1.1 04/02/ 2016	17/02/2016
Lesson Plan 2	V1.1 04/02/ 2016	17/02/2016
Curriculum Mapping	V1.1 04/02/ 2016	17/02/2016
Semi-structure Interview Guide	V1.1 04/02/ 2016	17/02/2016
Self-Efficacy Questions	V1.1 04/02/ 2016	17/02/2016
Headteacher Consent Form	V1.1 04/02/ 2016	17/02/2016
Interview Consent Form	V1.1 04/02/ 2016	17/02/2016
Letter to Parent/Guardian	V1.1 04/02/ 2016	17/02/2016
School Information Sheet	V1.1 04/02/ 2016	17/02/2016
Pupil Information Sheet	V1.1 04/02/ 2016	17/02/2016

I would be happy to discuss with you any of the issues raised above.

Yours sincerely,

Dr Jonathan Hewitt
Chair, School of Medicine Research Ethics Committee

Appendix 62 – Learn About Burns feasibility study. Examples from student draw and write exercises.

Figure 33 - Snapshot of draw and write exercise (group 1, student 2) from Learn About Burns feasibility study student focus group

Figure 34 - Snapshot of draw and write exercise (group 3, student 1) from Learn About Burns feasibility study student focus groups

Appendix 63 – Instances of missing data across knowledge, attitude, self-efficacy and practice questions by time-point from the Learn About Burns feasibility study (n = 269)

Question Number	Baseline (n = 269)	Post-Intervention (n = 269)	6 Month Follow-Up (n = 269)
1	.	.	.
2	.	.	.
3	.	.	.
4	.	1	.
5	.	.	.
6	1	.	.
7	.	.	.
8	.	1	.
9	.	.	.
10	.	.	.
11	.	1	.
12	.	.	.
13	.	.	.
14	.	.	.
15	1	.	.
16	1	.	.
17	1	.	.
18	.	.	.
19	.	.	.
20	.	.	.
21	.	.	.
22	.	.	.
23	.	.	.
24	.	.	.
25	.	.	.
26	1	.	.
27	.	1	2
28	.	.	.
29	1	.	.
30	.	.	1
31	.	3	.
32	1	.	2
33	.	.	.
34	.	.	.
35	.	/	.
36	.	/	.
37	.	/	.
38	.	/	.
Total	**7**	**7**	**5**

Note: ‘ / ‘ denotes where questions were not asked at this time-point

Appendix 64 – Number and % of knowledge results by question, answer and time-point for the Learn About Burns feasibility study (n = 269)

Table 1 - Question 1 - If something is too hot or too heavy for me to lift I should…

	A. Wait and ask an adult for help	B. Try anyway	C. Ask a younger brother or sister to help	D. I don't know
Baseline	227 (84.4%)	16 (5.9%)	3 (1.1%)	23 (8.6%)
Post-Intervention Delivery	260 (96.7%)	5 (1.9%)	1 (0.4%)	3 (1.1%)
Six Month Follow-Up	266 (98.9%)	0	1 (0.4%)	2 (0.7%)

Table 2 - Question 2 - If I am going to touch something hot I should…

	A. Touch it with the tips of my fingers to see if it is hot first	B. Use something to protect my hands	C. Pick it up with my hands straight away	D. I don't know
Baseline	17 (6.3%)	227 (84.4%)	4 (1.5%)	21 (7.8%)
Post-Intervention Delivery	2 (0.7%)	265 (98.5%)	1 (0.4%)	1 (0.4%)
Six Month Follow-Up	7 (2.6%)	261 (97.0%)	0	1 (0.4%)

Table 3 - Questions 3 - When making a cup of tea I should…

	A. Get everything I need out of the cupboards first	B. Get everything I need out of the cupboards after I have turned the kettle on	C. It does not matter which order I do things	D. I don't know
Baseline	125 (46.5%)	65 (24.2%)	43 (16.0%)	36 (13.4%)
Post-Intervention Delivery	252 (93.7%)	4 (1.5%)	6 (2.2%)	7 (2.6%)
Six Month Follow-Up	217 (80.7%)	27 (10.0%)	19 (7.1%)	6 (2.2%)

Table 4 - Question 4 – When filling a kettle I should…

	A. Fill the kettle all the way to the top	B. Only use the amount of water I need	C. Fill the kettle half way	D. I don't know	Missing
Baseline	13	175	56	25	0

	(4.8%)	(65.1%)	(20.8%)	(9.3%)	
Post-Intervention Delivery	0	249 (92.6%)	11 (4.1%)	8 (3.0%)	1 (0.4%)
Six Month Follow-Up	6 (2.2%)	231 (85.9%)	31 (11.5%)	1 (0.4%)	0

Table 5 - Question 5 - When pouring a hot liquid I should…

	A. Pour slowly and carefully away from me avoiding the steam	B. Pour very quickly	C. Pour slowly and carefully with the steam coming towards me	D. I don't know
Baseline	200 (74.3%)	7 (2.6%)	30 (11.2%)	32 (11.9%)
Post-Intervention Delivery	266 (98.9%)	1 (0.4%)	2 (0.7%)	0
Six Month Follow-Up	258 (95.9%)	1 (0.4%)	5 (1.9%)	5 (1.9%)

Table 6 - Question 6 - When filling a hot water bottle I should…

	A. Have the hot water bottle lying down on the kitchen side	B. Have the hot water bottle lying down in the sink	C. Hold the hot water bottle upright in front of me	D. I don't know	Missing
Baseline	38 (14.1%)	78 (29.0%)	103 (38.3%)	49 (18.2%)	1 (0.4%)
Post-Intervention Delivery	17 (6.2%)	238 (88.5%)	8 (3.0%)	6 (2.2%)	0
Six Month Follow-Up	10 (3.7%)	222 (82.5%)	18 (6.7%)	19 (7.1%)	0

Table 7 - Question 7 – How long does a cup of tea take to cool down so that it would not burn a child?

	A. 10 minutes	B. 30 minutes	C. 45 minutes	D. I don't know
Baseline	178 (65.4%)	53 (19.7%)	16 (5.9%)	24 (8.9%)
Post-Intervention Delivery	5 (1.9%)	22 (8.2%)	224 (83.3%)	18 (6.7%)
Six Month Follow-Up	38 (14.1%)	54 (20.1%)	161 (59.9%)	16 (5.9%)

Table 8 - Question 8 – Liquids and cooking appliances should be placed…

	A. On a flat and steady surface away from the floor	B. On the floor	C. On a wobbly surface away from the floor	D. I don't know	Missing
Baseline	221 (82.2%)	10 (3.7%)	5 (1.9%)	33 (12.3%)	0
Post-Intervention Delivery	257 (95.5%)	2 (0.7%)	3 (1.1%)	6 (2.2%)	1 (0.4%)
Six Month Follow-Up	264 (98.1%)	2 (0.7%)	0	3 (1.1%)	0

Table 9 - Question 9 – What should be used to cool a burn?

	A. Cold running water	B. Ice	C. A wet flannel	D. I don't know
Baseline	104 (38.7%)	107 (39.8%)	45 (16.7%)	13 (4.8%)
Post-Intervention Delivery	261 (97.0%)	4 (1.5%)	3 (1.1%)	1 (0.4%)
Six Month Follow-Up	246 (91.4%)	12 (4.5%)	11 (4.1%)	0

Table 10 - Question 10 – How long should you cool a burn?

	A. 5 minutes	B. 10 minutes	C. 20 minutes	D. I don't know	Missing
Baseline	65 (24.2%)	100 (37.2%)	86 (32.0%)	18 (6.7%)	0
Post-Intervention Delivery	1 (0.4%)	4 (1.5%)	261 (97.0%)	2 (0.7%)	1 (0.4%)
Six Month Follow-Up	6 (2.2%)	21 (7.8%)	238 (88.5%)	4 (1.5%)	0

Table 11 - Question 11 – What should be used to cover a burn?

	A. A plaster	B. Clingfilm	C. A bandage	D. I don't know
Baseline	39 (14.5%)	67 (24.9%)	120 (44.6%)	43 (16.0%)
Post-Intervention Delivery	1 (0.4%)	266 (98.9%)	0	1 (0.4%)

Six Month Follow-Up	6 (2.2%)	255 (94.8%)	5 (1.9%)	3 (1.1%)

Table 12 - Question 12 – When should I tell an adult?

	A. Straight away	B. Wait until you have finished cooling the burn	C. Wait until you have covered the burn	D. I don't know
Baseline	243 (90.3%)	11 (4.1%)	7 (2.6%)	8 (3.0%)
Post-Intervention Delivery	269 (100.0%)	0	0	0
Six Month Follow-Up	263 (97.8%)	3 (1.1%)	2 (0.7%)	1 (0.4%)

Table 13 - Question 13 – Should I put any creams on top of a burn?

	A. Straight away	B. Wait until you have finished cooling the burn	C. Wait until you have covered the burn	D. I don't know
Baseline	46 (17.1%)	90 (33.5%)	86 (32.0%)	47 (17.5%)
Post-Intervention Delivery	2 (0.7%)	27 (10.0%)	216 (80.3%)	24 (8.9%)
Six Month Follow-Up	2 (0.7%)	35 (13.0%)	223 (82.9%)	9 (3.3%)

Table 14 - Question 14 – Should clothing and jewellery be removed if they are close to the burn?

	A. Straight away	B. Wait until you have finished cooling the burn	C. I don't know
Baseline	194 (72.1%)	45 (16.7%)	30 (11.2%)
Post-Intervention Delivery	266 (98.9%)	2 (0.7%)	1 (0.4%)
Six Month Follow-Up	261 (97.0%)	7 (2.6%)	1 (0.4%)

Appendix 65 – Boxplots for free school mean and gender interactions by time-point for knowledge, attitude and self-efficacy results for the Learn About Burns feasibility study.

Figure 1 – Boxplot of free school meal level by overall knowledge score at baseline

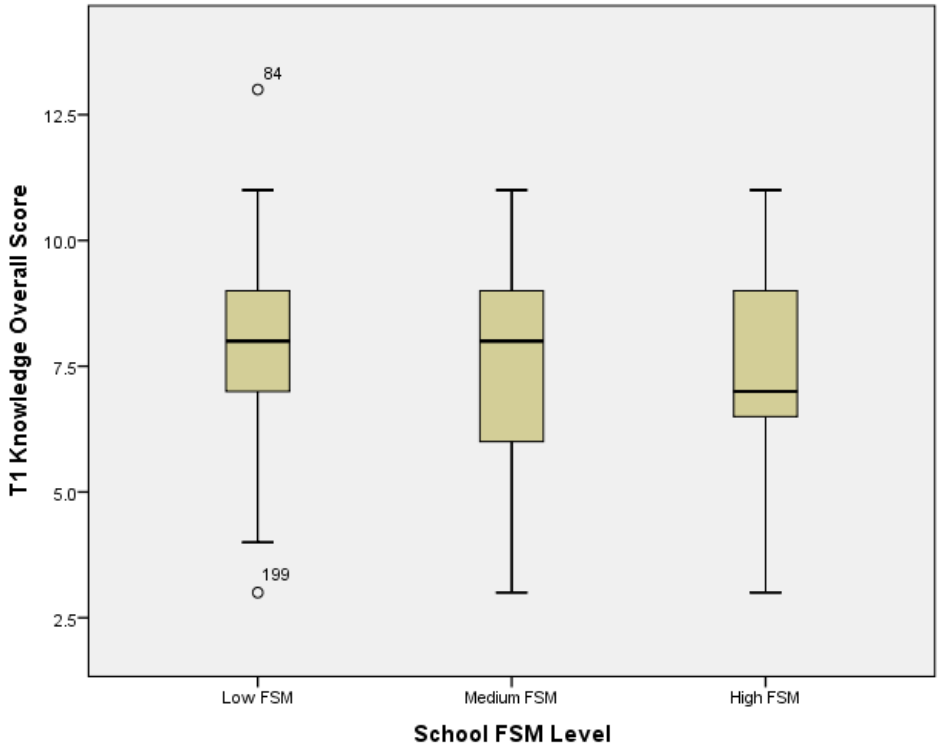


Figure 2 – Boxplot of free school meal level by overall knowledge score at post-intervention

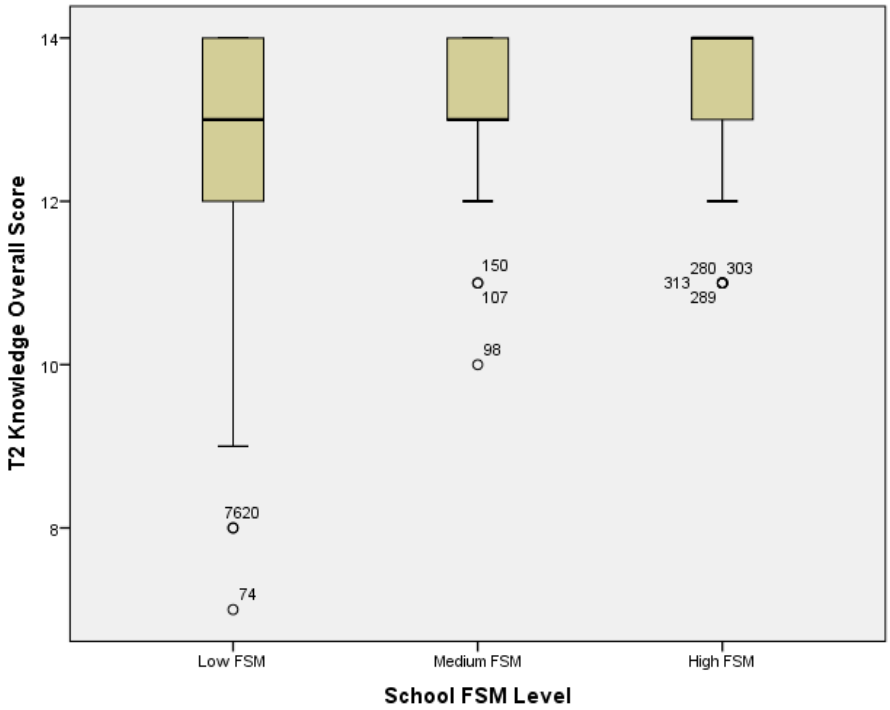


Figure 3 – Boxplot of free school meal level by overall knowledge score at six-month follow-up

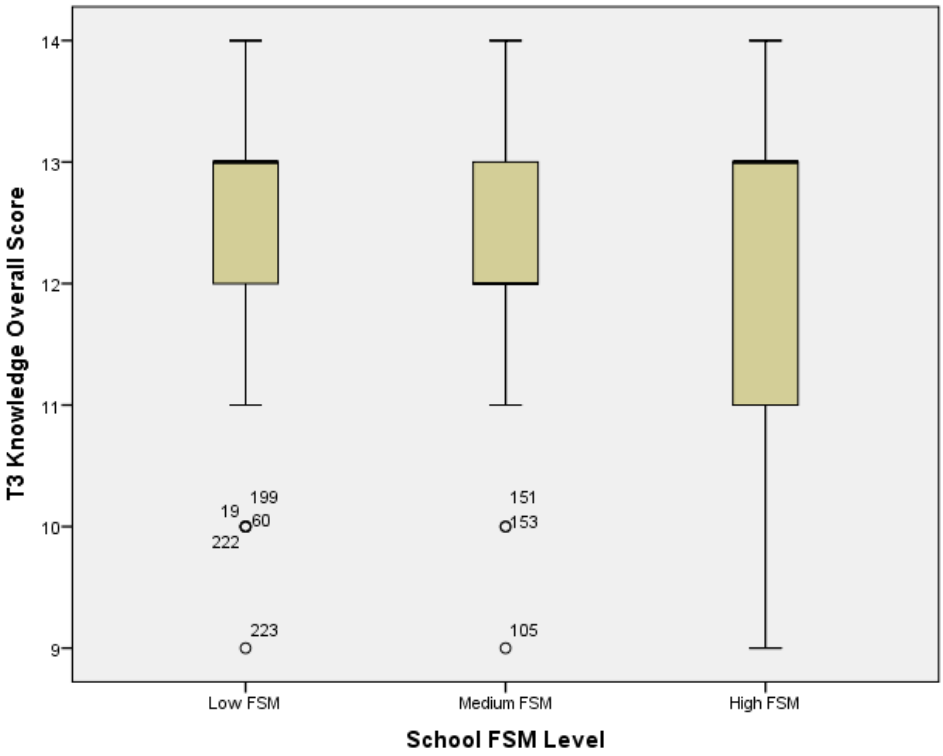


Figure 4 – Boxplot of free school meal level by overall attitude score at baseline

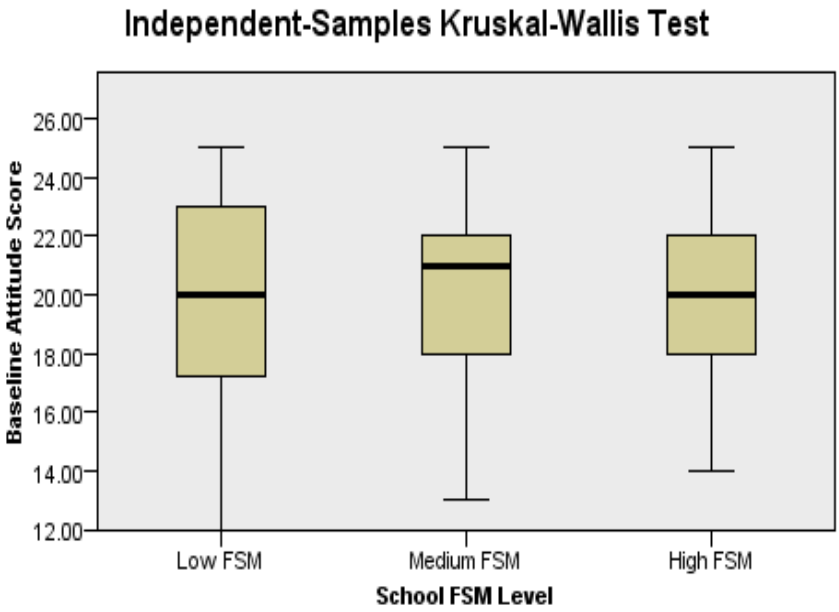


Figure 5 – Boxplot of free school meal level by overall attitude score at post-intervention

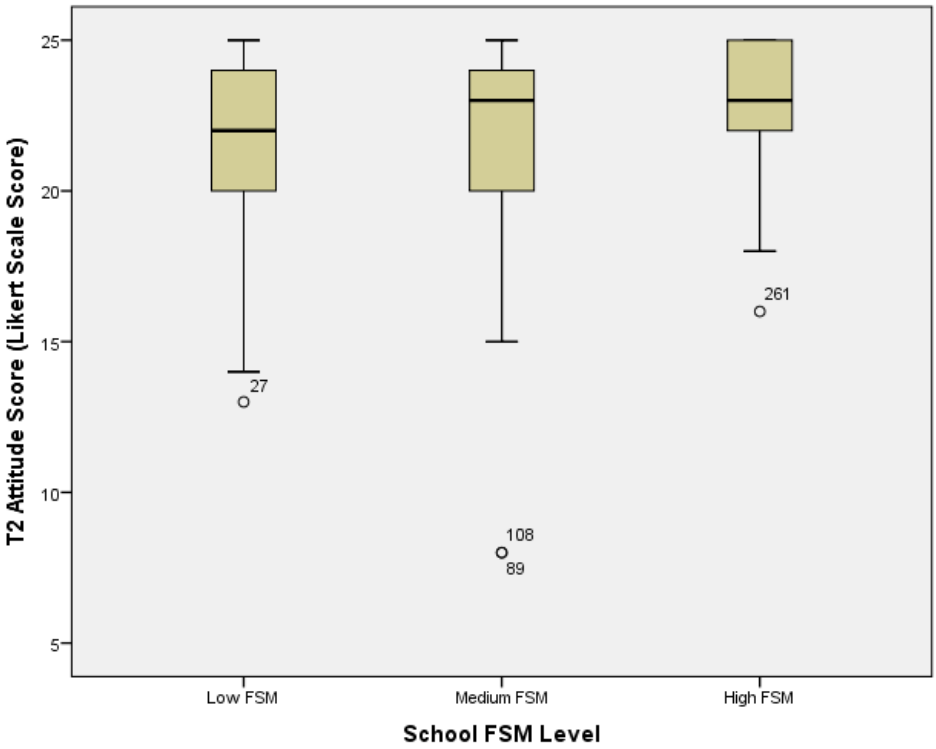


Figure 6 – Boxplot of free school meal level by overall attitude score at six-month follow-up

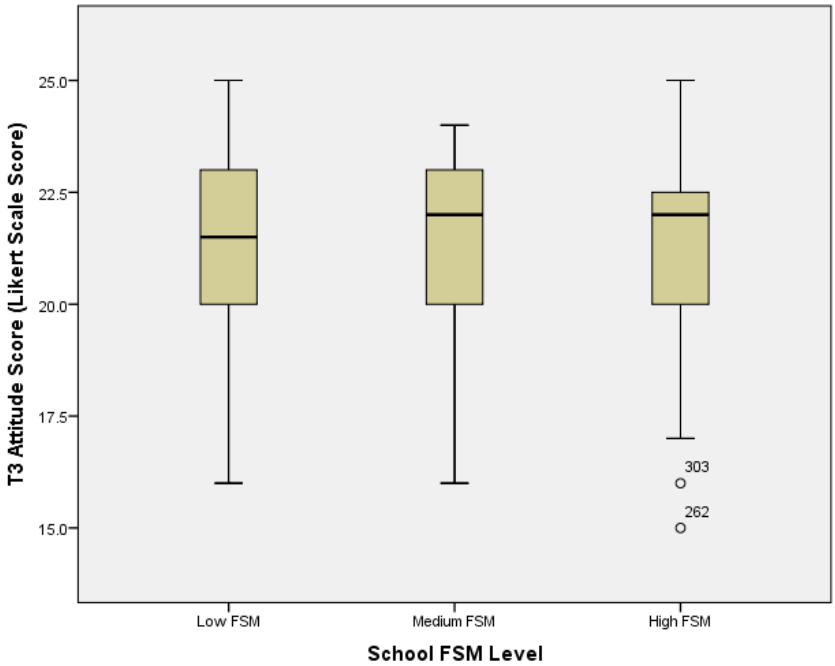


Figure 7 – Boxplot of free school meal level by overall self-efficacy score at baseline

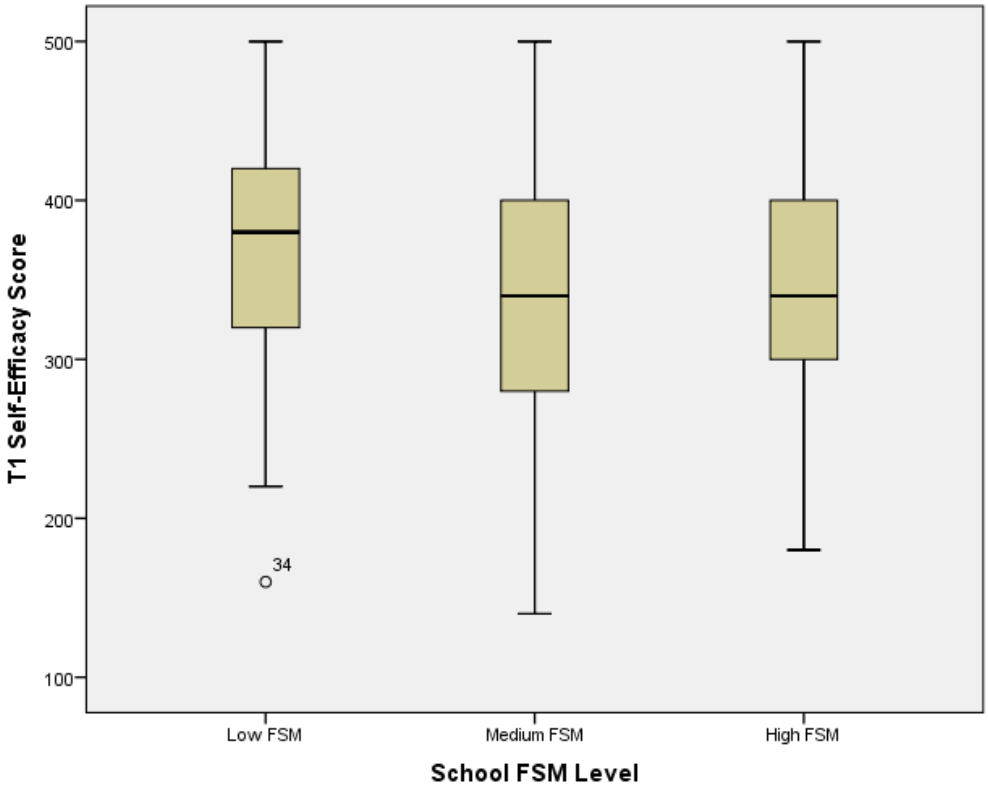


Figure 8 – Boxplot of free school meal level by overall self-efficacy score at post-intervention

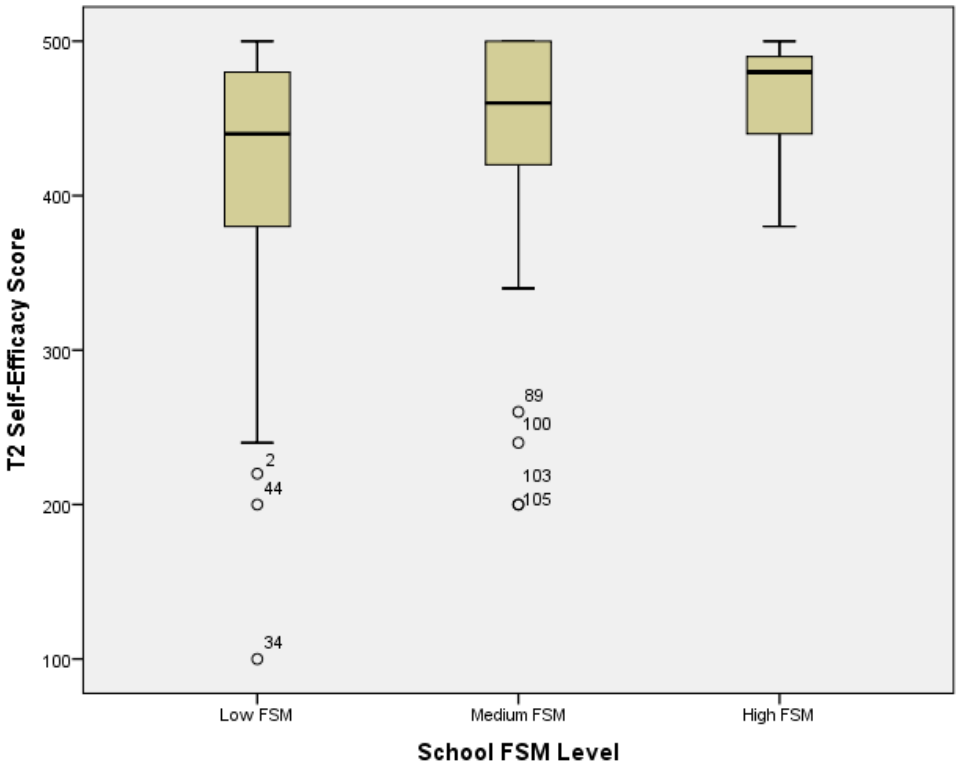


Figure 9 - Boxplot of free school meal level by overall self-efficacy score at six-month follow-up

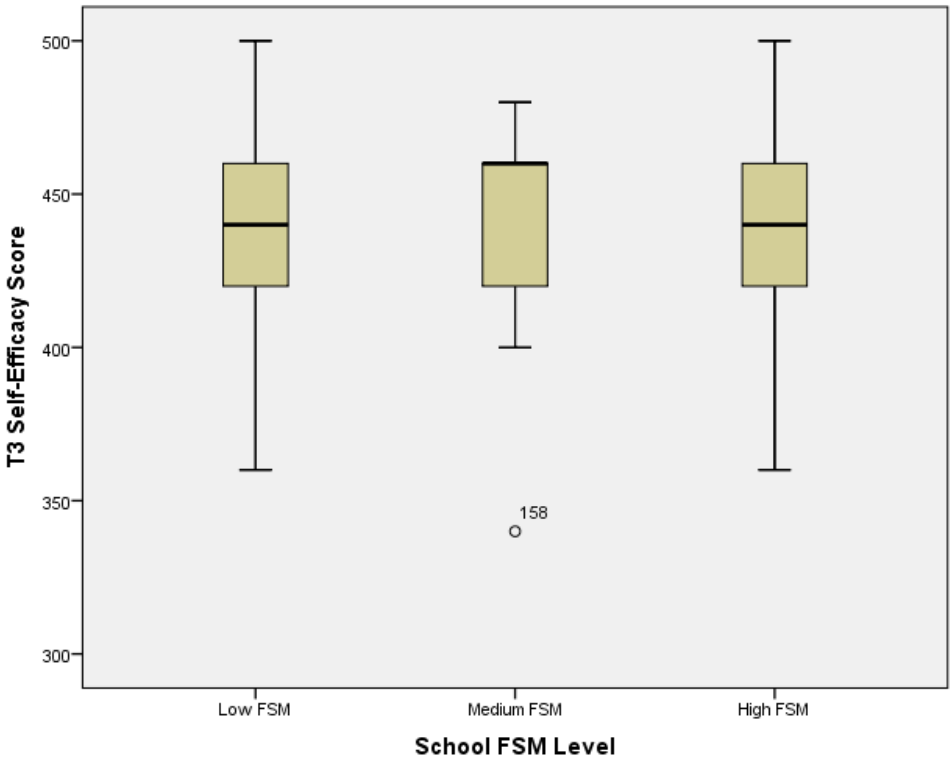


Figure 10 – Boxplot of gender by overall knowledge score at baseline

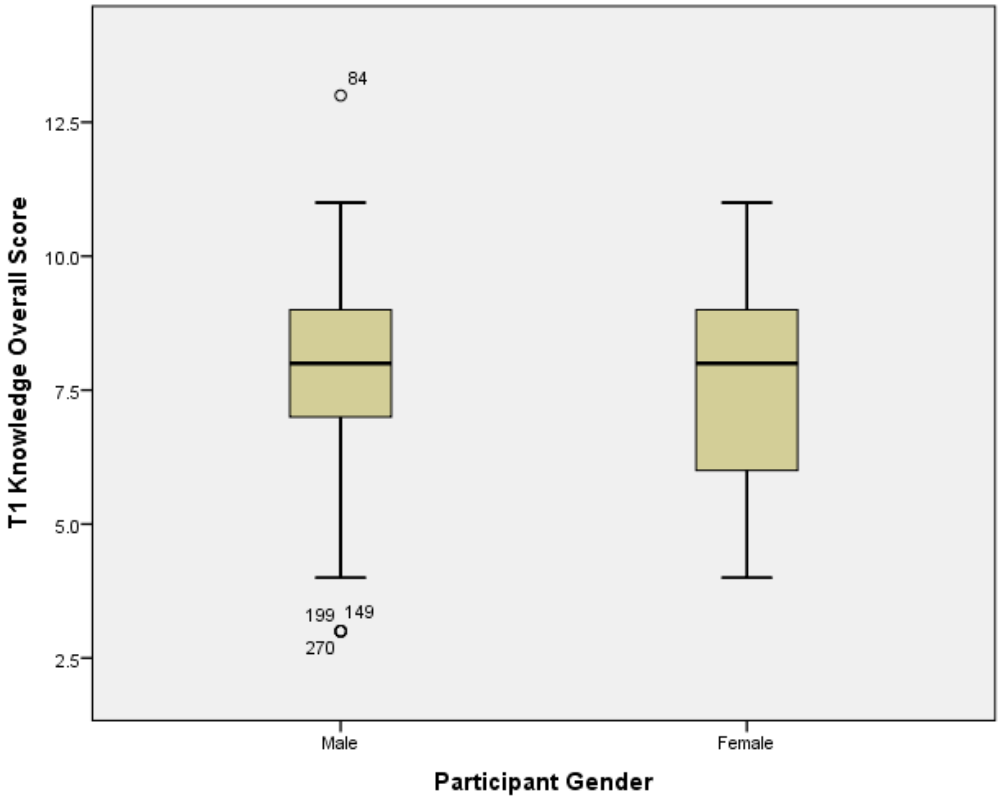


Figure 11 – Boxplot of gender by overall knowledge score at post-intervention

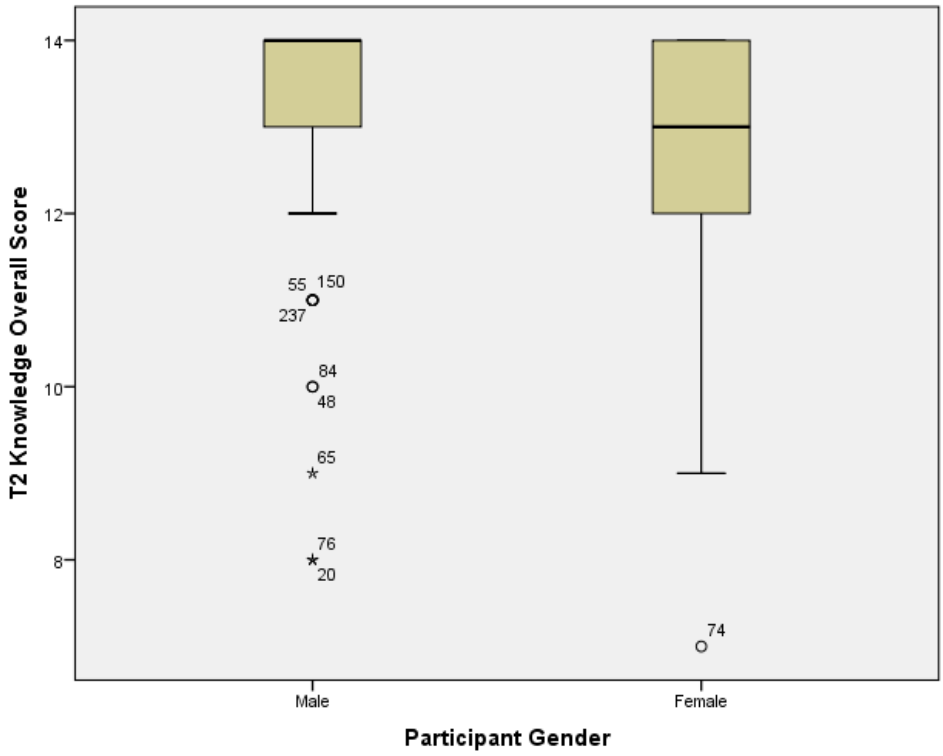


Figure 13 – Boxplot of gender by overall attitude score at baseline

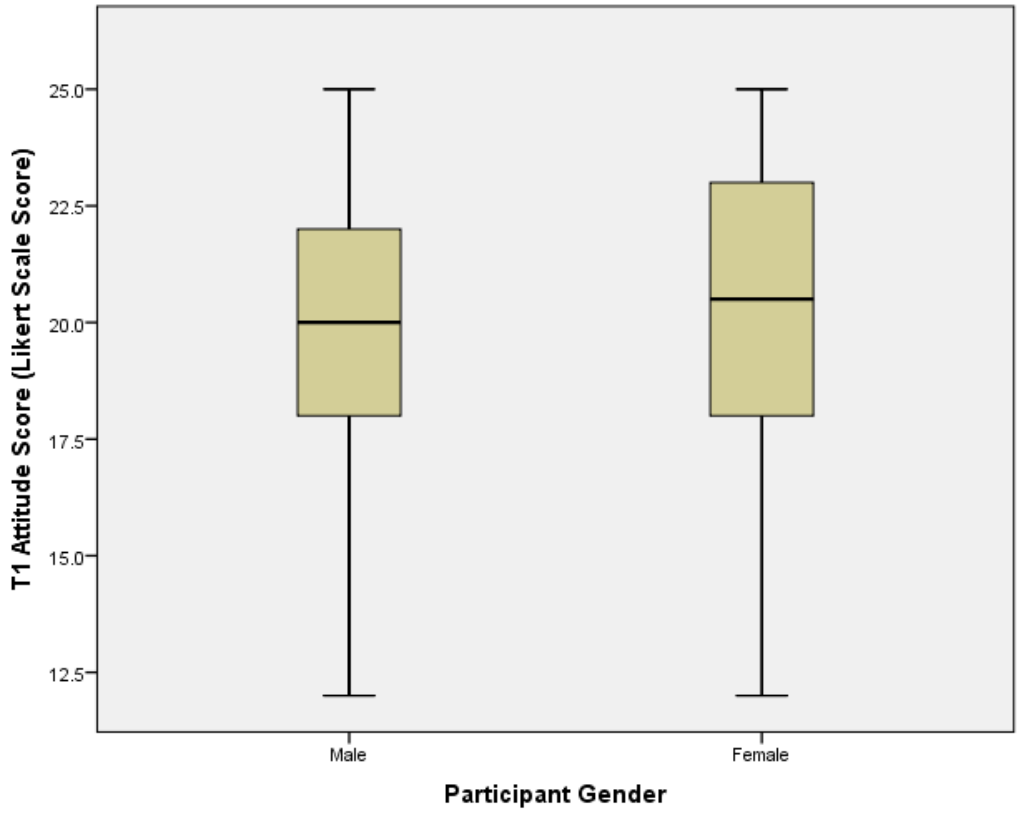


Figure 14 – Boxplot of gender by overall attitude score at post-intervention

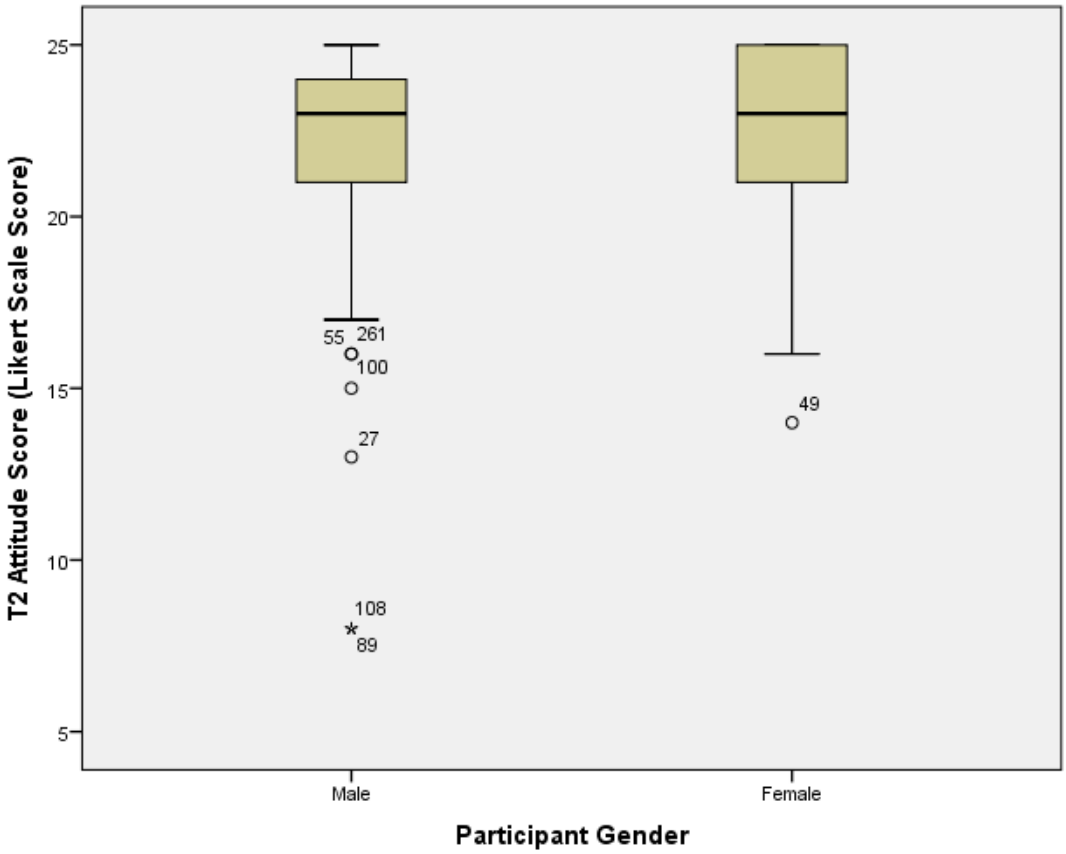


Figure 15 – Boxplot of gender by overall attitude score at six-months follow-up

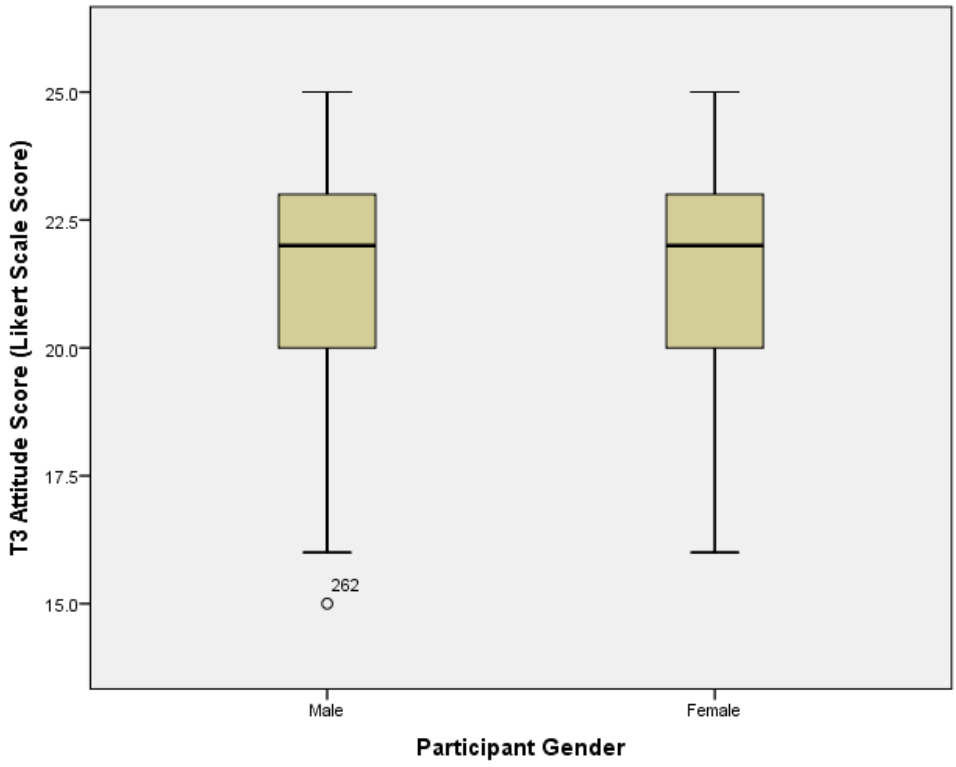


Figure 16 – Boxplot of gender by overall self-efficacy score at baseline

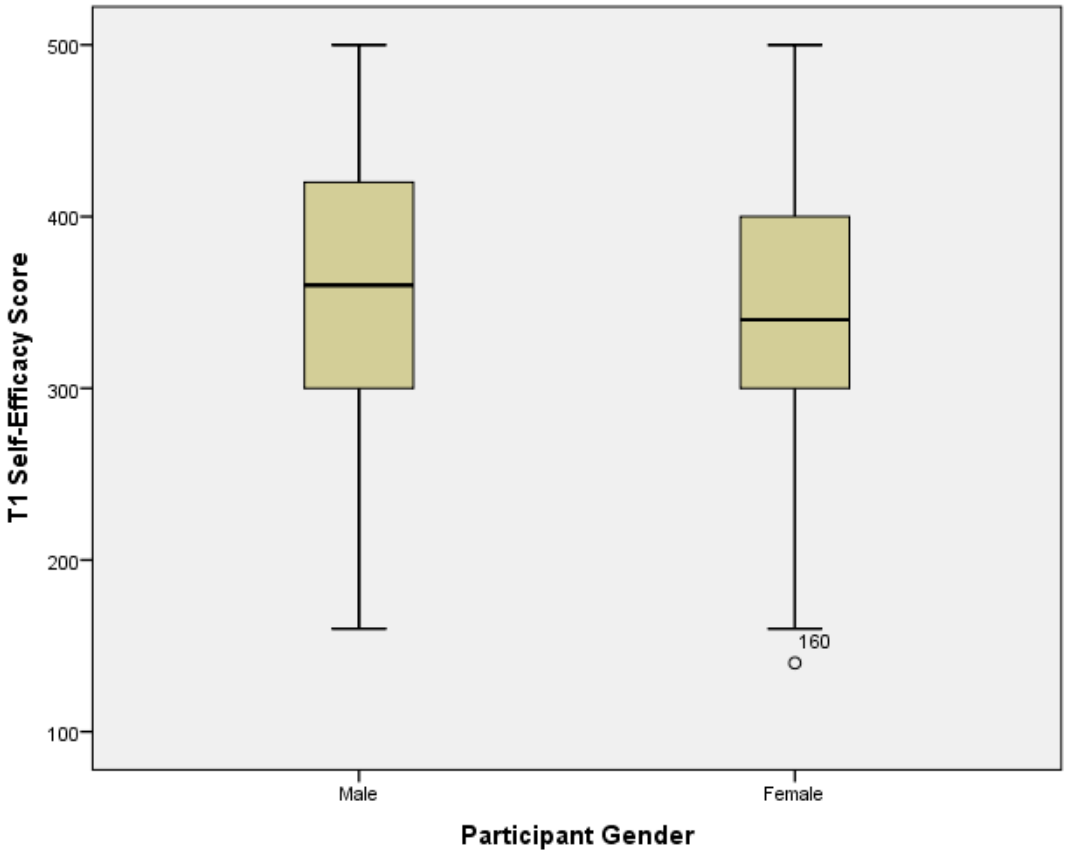


Figure 17 – Boxplot of gender by overall self-efficacy score at post-intervention

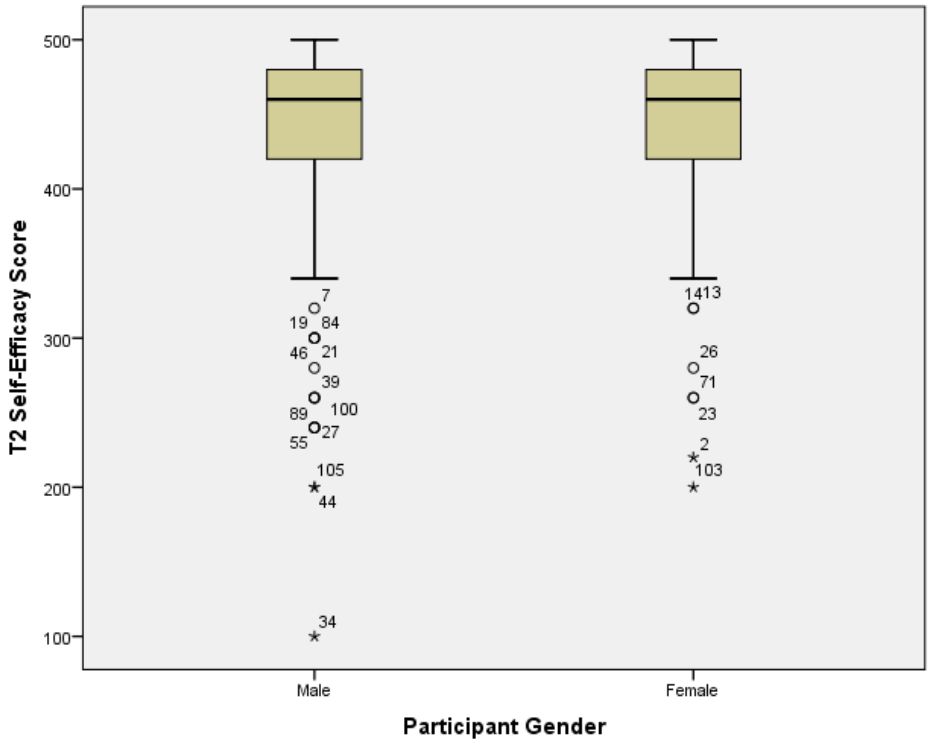
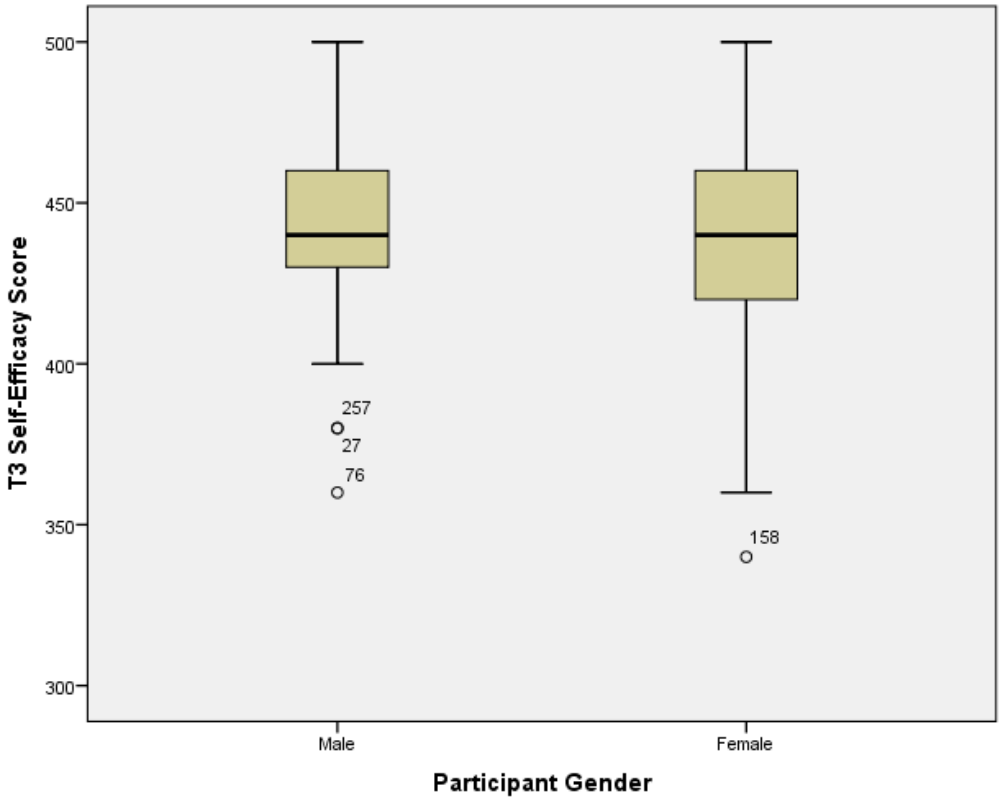


Figure 18 – Boxplot of gender by overall self-efficacy score at six-months follow-up



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